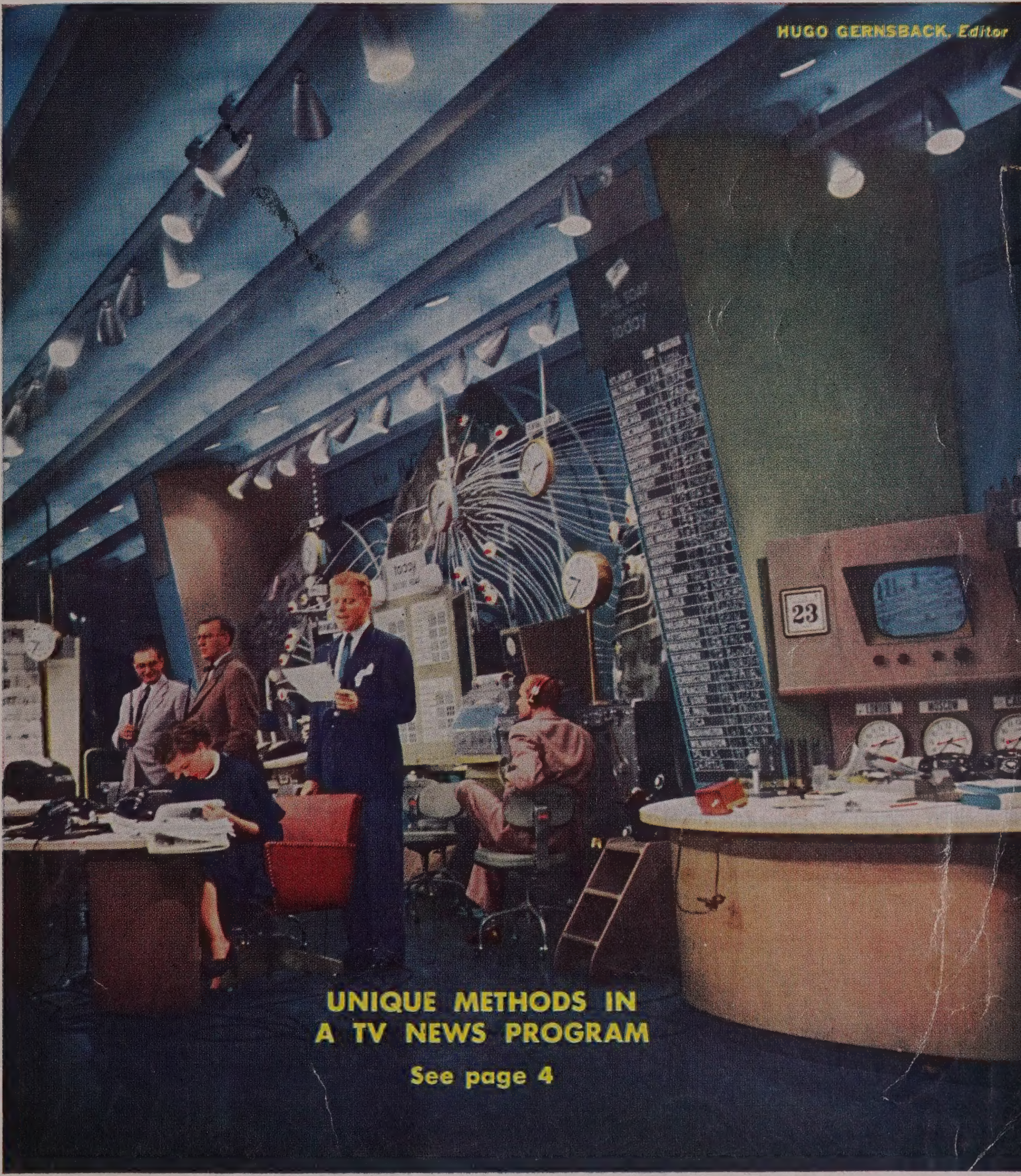
SEPTEMBER 1952

RADIO-ELECTRONICS

LATEST IN TELEVISION • SERVICING • AUDIO

HUGO GERNSBACK, Editor



UNIQUE METHODS IN A TV NEWS PROGRAM

See page 4

30¢

U. S. and CANADA

In this issue: **Frequency Stabilized Diathermy • Picture Tube Rejuvenators • Retrace Blanking**

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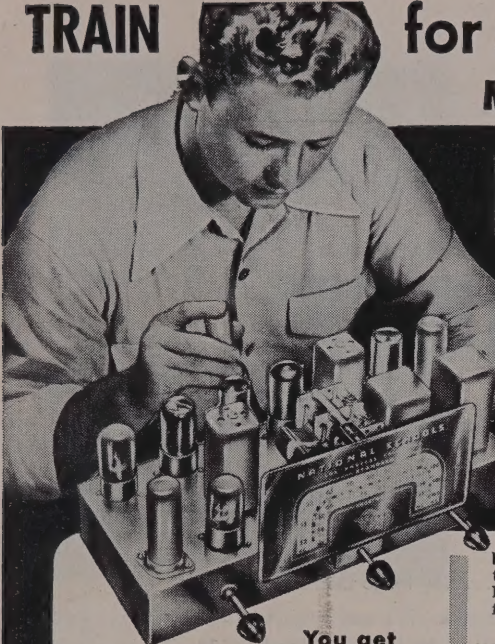

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YOU are wanted in Radio-Television-Electronics! America's fastest-growing field. High-pay jobs—the kind you've always wanted — are waiting for YOU!

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Trained Radio and Television technicians really make important money these days. Thousands of National Schools graduates—men just like you—are earning good money all over the country. Why not you? And—National Schools graduates get the personal satisfaction of being highly-skilled technicians. Men people respect. Men who *enjoy* their work—rather than having to drag along in just any old job.

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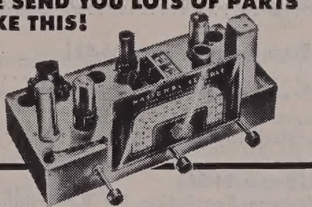
National Schools Shop Method Home Training gives you basic and advanced instruction in *all* phases of Radio-TV-Electronics. And remember—your training is based on resident school training principles. You learn *fast* from hundreds of diagrams and pictures. All instructions are written by experienced technicians who work in Radio and TV every day. All instructions have been developed and tested in National Schools' own labs and studios, which are equipped with the latest RCA equipment. No wonder this National Schools course is so up-to-date, practical, interesting. And so easy to learn! And no wonder it is held in such high regard by leaders of American industry! Approved for eligible Veterans.

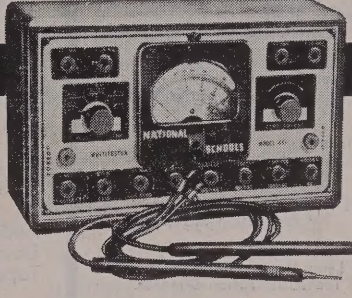
We Teach You How To Make Welcome Extra Money—While You Learn!

Many National Schools students—men like you—make plenty of extra dollars each week in spare time! Fixing neighbors' radios, appliances—and other ways we teach you. You start learning and earning from the day you enroll. From the very first lesson!

WE SEND YOU LOTS OF PARTS LIKE THIS!



With National Schools Shop Method Home Training, you get basic principles and plenty of *practical* training. *You learn by doing.* No wonder you learn so fast! We send you many parts—all of professional, modern quality. You do lots of practical experiments. You advance day by day, step by step. Until you can even build the modern Superheterodyne Receiver you see above—plus other important testing units. The free book tells you all about it. The free sample lesson shows how easy the training is. Use the coupon. Send today — without fail!



Only National Schools Gives You This Professional Multi-Tester!

You get this amazing, new testing instrument—factory-made and tested—complete—ready to use! Simple to operate. Accurate and dependable. An instrument every Radio-TV man needs. Light enough to carry around—so you can use it at home or on service calls. You'll be proud to own this valuable equipment.

Here are only a Few of the Good-Paying Jobs You Can Choose

Radio Station Engineer, District Service Manager, Aircraft Radio Inspector, Own Your Own Repair Shop, Inspector Technician, Service Specialist, Special Government Jobs, Complete TV Service, Sound Truck Operator. Many more!

National Schools graduates have secure, good-paying jobs like these! So don't wait—mail the coupon today. Now—while you're thinking about it!

Attention! Men Going into Service Soon!

National Schools' course quickly prepares you for many important jobs in the Armed Services. With National Schools Training you have an opportunity to get into *special* service classifications—with higher pay and grade—immediately!

FREE SERVICE FOR GRADUATES

National Schools uses its great influence and prestige to help you find your place in the field of your choice. Don't put it off! Start yourself toward a skilled trade! Get the big pay you've always wanted!

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DON'T PUT IT OFF! GET THE BIG SALARY YOU HAVE ALWAYS WANTED!

MAIL THIS COUPON TODAY—WITHOUT FAIL!

NATIONAL SCHOOLS, Dept. RG-92
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Mail in envelope or paste on penny post card.

Mail me FREE the book mentioned in this ad. Also a free sample lesson. I understand no salesman will call on me.

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ADDRESS ________________________

CITY ________________ ZONE ____ STATE ________

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RADIO-ELECTRONICS

Formerly RADIO-CRAFT • Incorporating SHORT WAVE CRAFT • TELEVISION NEWS • RADIO & TELEVISION*

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Vol. XXIII, No. 12 SEPTEMBER 1952

ON THE COVER
An action photograph (taken during the actual broadcast) of the *Today* broadcast from the studio in the RCA Exhibition Hall, New York City. Garroway is the middle one of the three standing men. *Color original by Avery Slack*

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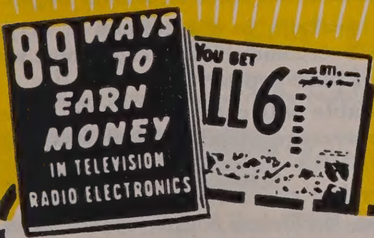
In addition to easy-to-read lessons, you get the use of HOME MOVIES — an outstanding training advantage — plus 16 big shipments of Electronic parts. Perform over 300 fascinating experiments for practical experience. Build and keep real commercial-type test equipment shown at right

Get BOTH of these information packed publications FREE!



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If you prefer, get all your preparation in our new Chicago Training Laboratories—one of the finest of its kind. Ample instructors, modern equipment. Write for details!

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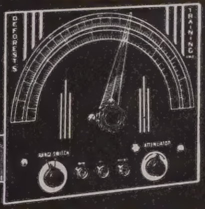
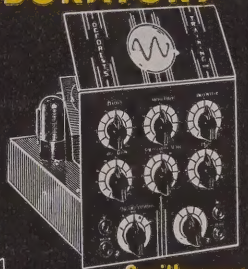
If you're subject to military service, the information we have for you should prove very helpful. Mail coupon today.

Here's the REAL THING!

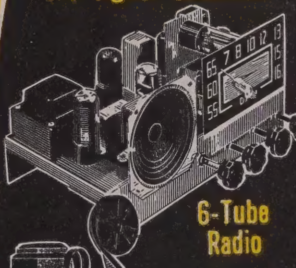
SET UP YOUR OWN HOME LABORATORY



R-F Signal Generator

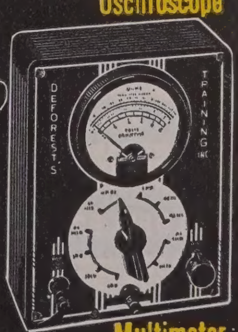


Oscilloscope



6-Tube Radio

Home Movies



Multimeter

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Without obligation, I would like your Opportunity News Bulletin showing "89 Ways to Earn Money in Television-Radio-Electronics"; also, the folder showing how I may prepare to get started in this thrilling field.

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Address...Apt.......

City.........................Zone..........State.......

"ONE OF AMERICA'S FOREMOST TELEVISION TRAINING CENTERS"

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A DeVRY INSTITUTION

FRANCE-BRITAIN SHARE TV in first international hookup. Paris programs were carried by microwave relay link to London and rebroadcast over BBC network. Special converters adapted French 819-line pictures to British 405-line transmission standards.

A five-nation network, adding Italy, Switzerland, and West Germany (all using 625-line transmission), is expected to be in operation by 1954.

NEW FCC APPROPRIATION of $6,408,480 carries $300,000 earmarked for new hearing examiners to handle the huge backlog of TV-channel applications. Cut by House-Senate action from $8,075,000 the new budget provides only half the number of examiners sought by the Commission.

IRE COMMUNICATIONS CONFERENCE in Cedar Rapids, Iowa, September 19 and 20, will feature five technical papers by outstanding authorities in addition to the exhibits, tours, and the University of Illinois, this president of Crosby Laboratories, will speak on Long-Range Communication Trends, and Dr. R. M. Page, associate director of research for Electronics, Naval Research Laboratory, will present a Comparative Study of Modulation Methods.

8TH NATIONAL ELECTRONICS CONFERENCE will be held September 29, 30, and October 1 at the Sherman Hotel in Chicago. Sponsored by the AIEE, IRE, Illinois Institute of Technology, Northwestern University, and the University of Illinois, this year's conference will include participation by other universities and the Society of Motion Picture and Television Engineers. Dr. J. A. M. Lyon of Northwestern Technological Institute has been named president.

PROFESSOR A. C. B. LOVELL'S article on the Jodrell Bank radio telescope, referred to on page 10 of the July, 1952, RADIO-ELECTRONICS, appeared in July, 1951, not in May, 1951, as stated in this department in July.

NEW DIVERSITY TRANSMISSION helps mobile communications receivers overcome static and fading where utmost dependability is vital. Developed by RCA, the system is the outgrowth of long experience with space-diversity reception, where fading at one location is generally accompanied by an increase in signal strength some distance away. Combining the outputs of two or more receivers fed by widely separated antennas and controlled by a common a.g.c. system gives a highly uniform output.

Similar results are now obtained with spaced transmitters and a single receiving antenna. Recent tests between Bolinas, California, and New York showed signals 4 to 30 times stronger with the new system.

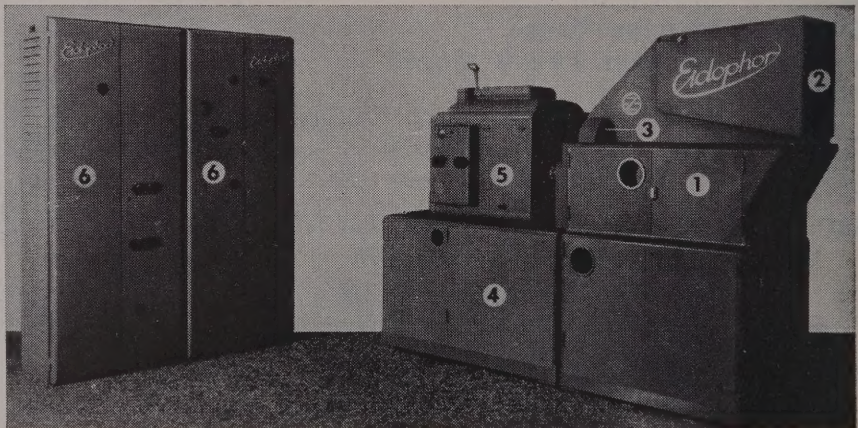
FRENCH-LANGUAGE RADIO NETWORK for central and western Canada was approved by CBC. Six stations will be added: two each in Ontario and Saskatchewan, one each in Manitoba and Alberta. A 15-station network now serves Quebec, Canada's largest French-speaking province.

EIDOPHOR COLOR-TV SYSTEM for theater use (first reported here in the October, 1946, issue of this magazine) was demonstrated recently in New York City by Twentieth Century-Fox Film Corporation. Still under development, the Swiss-invented system projects an electronically-formed image by familiar film-projection technique on a standard theater-size motion-picture screen.

Instead of depending on the light generated by the electron beam of the picture tube, the Eidophor system uses an arc-lamp as a source of illumination. Its light is modulated by the television signal.

The system was described completely in this magazine in October 1946, but at that time the equipment was very cumbersome, occupying three stories of the building in which it was installed.

The photograph shows the complete Eidophor installation in its present form.



Eidophor installation. 1—Projector. 2—Projection light-beam hood. 3—Color wheel. 4—Auxiliary units (vacuum pump, thermostat, and cooling system). 5—Projection lamp (Ventarc type). 6—Television receivers and power-supply units.

CHANNEL MASTER

proudly introduces

the world's first Broad Band Yagi

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A great new type of antenna that combines:

- **Broad Band coverage** *with the*
- **high gain and directivity of the Yagi**

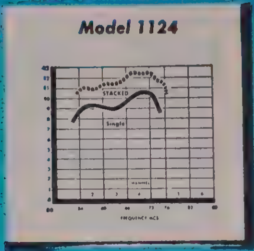
Spectacular high gain! Razor-sharp directivity! In fact, all the brilliant performance that only a Yagi can deliver, is now yours with the FUTURAMIC — not on just one channel, but CLEAR ACROSS THE BAND!

For the first time in television history, here is an antenna that not only solves today's installation problems — but also provides for the new VHF channels of the future. This is the antenna you have been waiting for — the 10 Element FUTURAMIC is a true Broad Band Yagi!

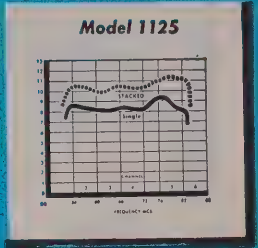
the antenna designed for today and tomorrow!

The same **FUTURAMIC** that . . .
- Solves today's reception problems
- Will also receive tomorrow's new VHF channels

GAIN CURVES

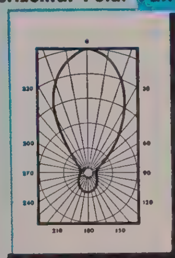


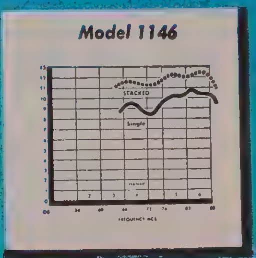
Covers Ch. 2, 3, 4



Covers Ch. 2, 3, 4, 5

Horizontal Polar Pattern





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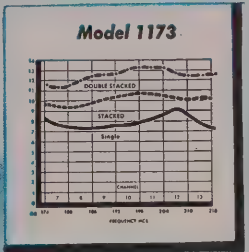

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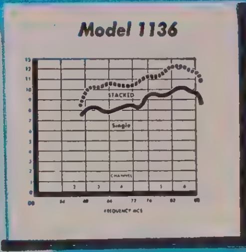


Covers Ch. 3, 4, 5, 6

THE FUTURAMIC MEANS BIG BUSINESS FOR YOU IF YOU SERVE ANY OF THESE 3 BOOMING VHF MARKETS!

1. Areas in which the FCC has ordered VHF stations to change channels (on the same band).

When a channel-shift takes place, the thousands of *single*-channel Yagis in use will become obsolete overnight. The set owner will face a dilemma: If he changes his antenna *before* the channel-shift, he will be without reception until the shift occurs. If he waits until the station changes channels, he will be without reception until his new antenna is installed. You can install the Futuramic now — before the rush starts! It will provide *better* reception than conventional Yagis on the *present* channels—and when the shift occurs, this superior reception will continue on the new channel without interruption!

2. Areas in which a new VHF station is being added to the present one.

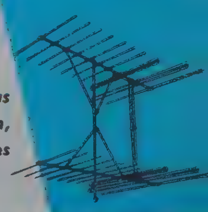
The hundreds of thousands of single-channel Yagis now in use will not bring in the new channel. This means that an additional Yagi will have to be installed and tied into the present installation with a separate lead, through an annoying switching system. However, one Futuramic will do the job of *both* antennas — at lower cost — with better results on *both* channels. Install the Futuramic now to improve your present picture. And at the same time be ready for future channels on the same band.

3. Areas served at present by two or more VHF stations (on the same band).

In such areas, the installation man must choose between conventional broad band antennas and separate Yagis for each channel. Each approach has important advantages. Only the Futuramic will give you the advantages of BOTH, combining highest gain, and sharpest directivity *on each channel* with simple, economical installation.

ALL THIS AND Z-MATCH TOO!

The Futuramic uses Channel Master's famous Z-Match system which eliminates mismatch, gives maximum stacking gain, and provides stacking bars at no extra cost.



Model No.	Channels Covered	List Price
1173	7, 8, 9, 10, 11, 12, and 13	$20.83
1124	2, 3, and 4	$40.97
1125	2, 3, 4, and 5	
1136	3, 4, 5, and 6	
1146	4, 5, and 6	

SHATTERS all performance records!

- Channel for channel, the Broad Band Futuramic will outperform any conventional SINGLE-CHANNEL Yagi!
- On each of its specified channels, one single Low Band Futuramic will outperform any 4-bay conical or fan array!
- A single High Band Futuramic will outperform any 2-bay conical or fan array on every channel from 7 to 13!
- A high-low Futuramic combination is the most sensitive array ever devised for all-channel VHF reception!

Write for complete technical literature.

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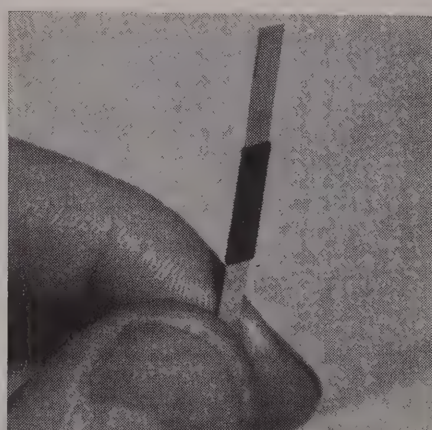
MEMBER

NAVY'S NEW BISMANOL MAGNETS have the highest coercive force known, use no critical nickel or cobalt. Developed in the Naval Ordnance Laboratory, Bismanol is an alloy of bismuth and manganese, both non-magnetic elements. Equal to Alnico in maximum energy product (3×10^6 gauss-oersteds), Bismanol has the further advantage that it can be pressed at relatively low temperatures into complicated shapes. The photograph shows microscopic crystals of the new magnetic material before separation from the basic alloy.


Photomicrograph of Bismanol crystals.

ADHESIVE-TAPE RESISTORS, developed some time ago by the National Bureau of Standards for printed circuits, now are pre-cured for immediate use without further treatment. In the new form, wire or metal-ribbon leads are sandwiched between two resistor tapes. The assembly is then heat treated to stabilize the resistance and seal the lead contacts. The cured unit may be soldered or spot-welded directly in the circuit. The photograph shows the appearance of the new resistors.


New pre-cured adhesive-tape resistor.

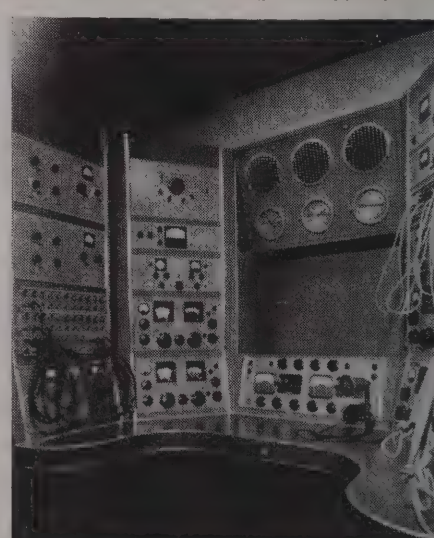
END OF COLOR-TV BAN, reported in June by National Production Authority means little to set owners and manufacturers, say industry spokesmen. Continued restrictions on use of materials and personnel for nondefense production block any immediate resumption of color-set manufacture.

EMERSON RADIO GIVES $100,000 in grants of $10,000 each to the first 10 educational-TV licensees to begin regular programs. In announcing the gift, Emerson president Benjamin Abrams called on industry to establish a $5 million fund which would help set up noncommercial stations as quickly as possible throughout the country. Mr. Abrams also proposed a national council of outstanding educators, artists, scientists, and public leaders to develop the cultural potentialities of educational TV.

BRIGADIER GENERAL SARNOFF—chairman of the board of directors of RCA—was awarded RTMA's first Medal of Honor at the association's recent annual convention. RTMA chairman Robert C. Sprague presented the award as a tribute from General Sarnoff's colleagues, "in recognition of many notable achievements toward the development and progress of the radio-television industry."

PRESIDENTIAL COMMUNICATIONS CAR, designed by the Army Transportation Corps and Signal Corps, is now in service. Through its advanced facilities the Chief Executive can communicate with Washington by radio or wire from any part of the country. The photograph of the control console shows only part of the receiving and transmitting equipment. Multiple antennas, some demountable, provide dependable communications even while the President's train is in motion.


The President's new communications car.


Photos courtesy Hammarlund Mfg. Co.
Radio section of the control console.

—end—

the greatest Yagi of them all

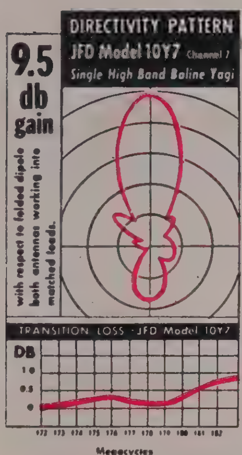
JFD 10-ELEMENT "Baline" YAGI

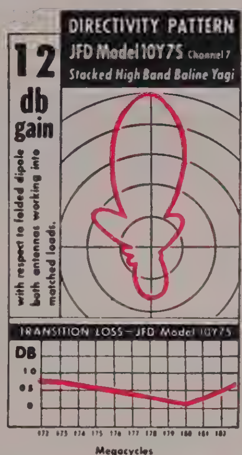
***12 db** *(gain of stacked JFD BALINE over a tuned folded dipole)*

***9½ db** *(gain of single JFD BALINE over a tuned folded dipole)*

*These figures have been verified by the Hazeltine Corporation, world famous research laboratory. All JFD gain figures are based on a reference tuned folded dipole. Beware of exorbitant gain figures which are not based on any reference level.

ACTUAL FIELD TESTS PROVE IT





Single JFD High Band BALINE Yagis

Channels	Models	List Price
7-13	10Y7-10Y13	$13.85

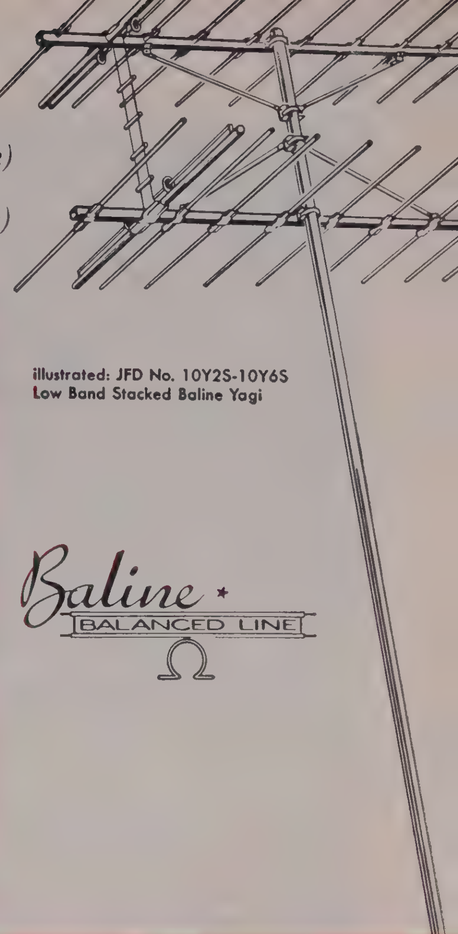
Stacked JFD BALINE Yagis

Channels	Models	List Price
2	10Y2S	$63.70
3	10Y3S	63.70
4	10Y4S	56.90
4-5	10Y45S	67.80
5	10Y5S	56.90
6	10Y6S	51.40
7-13	10Y7S-10Y13S	27.70

Include JFD Baline matching transformers at no extra charge

Single JFD Low Band BALINE Yagis

Channels	Models	List Price
2	10Y2	$31.85
3	10Y3	31.85
4	10Y4	28.45
4-5	10Y45	33.90
5	10Y5	28.45
6	10Y6	25.70

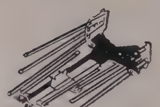


illustrated: JFD No. 10Y2S-10Y6S Low Band Stacked Baline Yagi

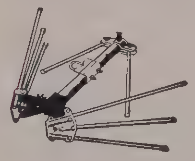
Baline * BALANCED LINE Ω

The antenna sensations of the Nation!

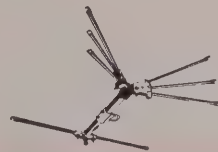
JETENNA... the conical with jet-action assembly *no other fan conical assembles so fast, performs so well!*



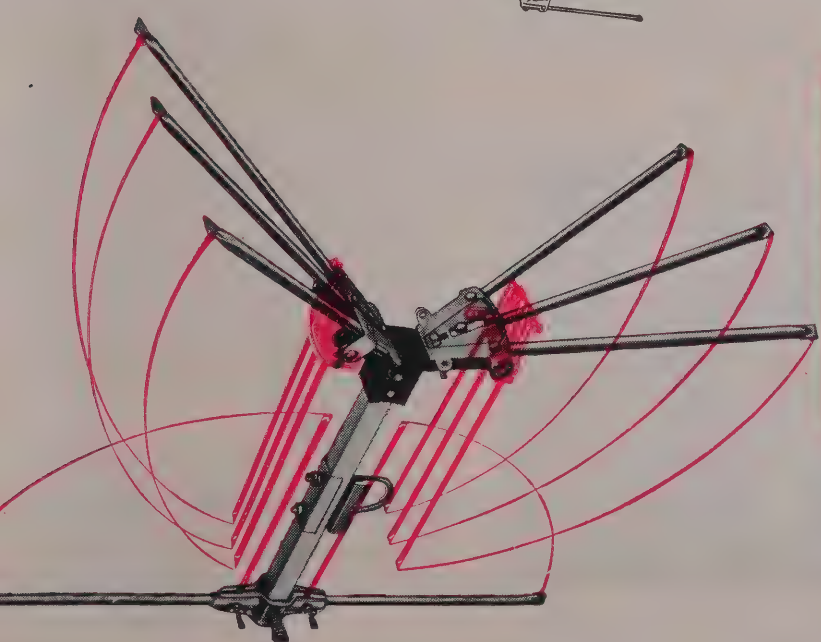
1. Pre-assembled JFD JeTenna as packaged. Note its compactness of construction and craftsmanship of design.



2. As the JeTenna swings open, dipole elements fan instantly into exact position by riding along unique fulcrum indices.



3. JeTenna elements lock into position effecting 35° forward inception angle and 40° dipole angulation for greater signal pickup. Reflectors snap into place for quick tightening by wing nuts.



Series with 1" seamless aluminum square crossarm and seamless aluminum elements reinforced with Fibreglas dowels.

No. JET160	Single Bay	Up to 8.8 db*	$12.50 list
No. JET161	2 Bay	Up to 12.5 db*	$26.40 list
No. JET164	4 Bay	Up to 15.5 db*	$56.80 list

Series with 1" seamless square aluminum crossarm and wood-doweled butt-seam aluminum elements.

No. JET660	Single Bay	Up to 8.8 db*	$ 9.75 list
No. JET661	2 Bay	Up to 12.5 db*	$20.70 list
No. JET664	4 Bay	Up to 15.5 db*	$45.40 list

*Performance tested and figures verified by the Hazeltine Corporation, Little Neck, N.Y. World Famous Research Laboratory.

JFD MFG. CO.
BROOKLYN 4, N. Y.
BENSONHURST 6-9200

World's Largest Manufacturer of TV Antennas and Accessories

BAROMETER of the PARTS INDUSTRY

During July, 51 of the leading 400 manufacturers of radio-television-electronic parts and equipment made changes in their lines. Actually there was a decrease in "change activity" as compared to June.
In price revisions by the number of manufacturers and products affected, the following summary illustrates the comparative trend for the months of June and July.

	No. of Manufacturers	
	June	July
Increased prices	10	4
Decreased prices	16	17

	No. of Products	
	June	July
Increased prices	67	7
Decreased prices	315	88

For a summary of the most active product categories, see the following table:

Product Group	Increased Prices		Decreased Prices		New Products		Discontinued Products	
	No. of Mfrs.	No. of Products	No. of Mfrs.	No. of Products	No. of Mfrs.	No. of Products	No. of Mfrs.	No. of Products
Antennas & Access.	0	0**	1	9**	11	106**	4	20**
Capacitors	0	0	1	2*	2	42*	0	0
Controls & Resistors	0	0	0	0	1	2**	1	235*
Power Supplies	0	0	0	0	1	19	1	2
Sound & Audio	0	0	3	8**	16	173*	0	0**
Test Equipment	0	0**	0	0	6	37*	1	2**
Transformers	0	0	0	0	1	117*	0	0
Tubes	2	5**	7	44**	7	41*	2	5**

* Increase over June
** Decrease from June

Comment: Activity in the electronic industry continues to center upon the introduction of new products with antenna and audio manufacturers being the most active. Price increases and decreases remain quite minor with revisions occurring among tube manufacturers.

This data is prepared by the staff of United Catalog Publishers, Inc., 110 Lafayette Street, New York City, publishers of RADIO'S MASTER, the Official Buying Guide of the Parts Industry.

Merchandising and Promotion

RCA Victor embarked on the largest and most comprehensive advertising campaign for its TV and radio receivers and phonographs in company history. The third-quarter drive made prolific use of consumer magazines and newspapers, backed up by trade-press and direct-mail advertising, radio and television commercials and point-of-purchase displays.

Simpson Electric Co., Chicago, released a new two-color envelope stuffer giving illustrations, specifications, and other pertinent data on its instruments for TV and FM servicing. Data on the new Simpson model 485 synchronized cross-hatch pattern generator is included.

Insuline Corp. of America, Long Island City, N. Y., is offering its distributors a new counter display card to promote the sale of its concealable indoor antennas for FM and television reception.

RCA's Tube Department devised a special "Converkit" containing the company's first "universal" horizontal-deflection-output and high-voltage transformer and a ferrite-core deflecting yoke, for converting small-screen television receivers to use picture tubes up to 21 inches. The kit was designed as an attractive display and to simplify the service technician's stock problems.

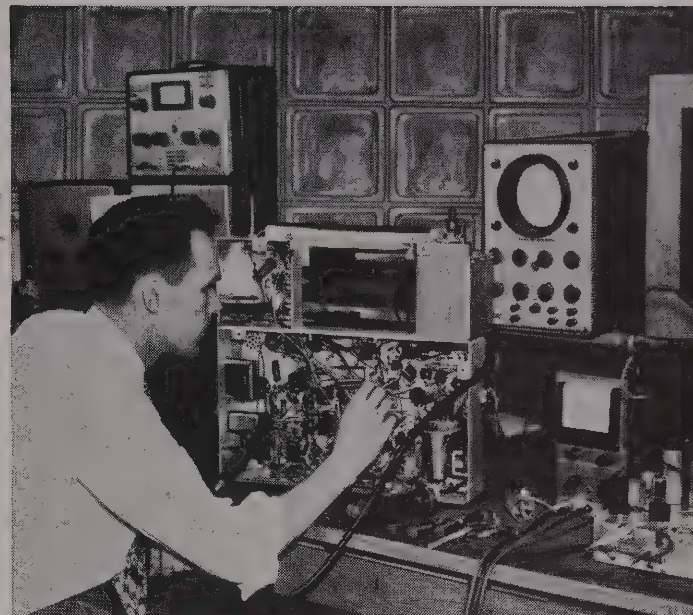
New Plants and Expansions

Allen B. Du Mont Laboratories established a new replacement sales department of its Cathode-Ray Tube Division. Edwin B. Hinck, previously manager of electronics parts sales, heads the new department, with headquarters in Clifton, N. J.

General Electric opened a new $6,000,000 electronic tube plant near Anniston, Ala. At the dedication ceremonies Ralph J. Cordiner, president of G-E, announced that within the next two years the Southeastern area of the United States will become a major center in the company's operations.

RMS, New York City, acquired a new plant at 2016 Bronxdale Ave., which provides approximately 45,000 square feet of space. The company's Antenna Division will remain at its West Farms Road plant. The former plant and

Here's your Opportunity



to prepare for a good job or a business of your own in TV SERVICING

There are today more good jobs open in TV Servicing than there are trained and experienced men to fill them. Yes, thousands of opportunities exist now for good-pay jobs offering employment security for years and years to come. Thousands of TV Servicing jobs are going begging. Do you want one of them?

Experts agree, that because of the critical shortage of trained and experienced TV Servicemen, and the tremendous future growth of the industry, no vocational field today offers more opportunities than TV Servicing.

The Big New Industry with a Great Future

Television is just in the beginning stages of its big industrial boom. Look at these amazing facts:

- Lifting the freeze on new TV stations will open many new TV areas and will improve the coverage of existing areas. The result will be an enormous demand for TV receivers.
- Within a few years over 1000 TV stations will be telecasting compared with 108 TV stations now on the air.
- Nearly one-half of all families living within the present TV areas do not yet own TV receivers.
- The new trans-continental video network plus better and more interesting programs plus larger viewing screens and color TV will increase the installation of new receivers, will induce present owners of 12-inch and smaller size viewing screens to buy newer model receivers.
- The power increases of many existing stations and improved reception range of current receivers will result in receivers being installed and serviced in the fringe areas of present stations.
- Under the FCC proposal, over 70 per cent of all communities will be served by UHF channels exclusively. This means TV servicemen must know UHF receivers before the new UHF stations in their area are opened.
- No one yet knows how great the industrial TV market will be.

RCA Institutes Home Study Course prepares you for a Career in TV Servicing

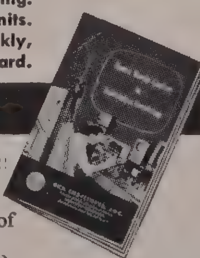
The addition of the RCA Institutes TV Service Training to your present radio-electronics experience will qualify you to step out and grasp the golden opportunities that now exist in television—America's fastest growing industry.

Learn at home—in your spare time—while you study the practical *how-to-do-it* techniques with *how-it-works* information. Easy-to-read and easy-to-understand lessons under the supervision of RCA engineers and experienced instructors quickly train you to qualify for the many good jobs now waiting for trained TV servicemen. Don't pass up this lifetime opportunity for financial security and a bright future in TV. Learn TV Servicing from RCA—pioneers and leaders in radio, television and electronic developments.

RCA Institutes conducts a resident school in New York City offering day and evening courses in Radio and TV Servicing, Radio Code and Radio Operating, Radio Broadcasting, Advanced Technology. *Write for free catalog on resident courses.*

Send for FREE BOOKLET

Mail the coupon—today. Get complete information on the RCA INSTITUTES Home Study Course in Television Servicing. Booklet gives you a general outline of the course by units. See how this practical home study course trains you quickly, easily. Mail coupon in envelope or paste on postal card.



MAIL COUPON NOW!

RCA INSTITUTES, INC., Home Study Department RE-952
350 West Fourth Street, New York 14, N. Y.

Without obligation on my part, please send me copy of booklet "RCA INSTITUTES Home Study Course in TELEVISION SERVICING." (No salesman will call.)

Name____________________
(please print)

Address____________________

City__________ Zone______ State__________

RCA

RCA INSTITUTES, INC.

A SERVICE OF RADIO CORPORATION of AMERICA
350 WEST FOURTH STREET, NEW YORK 14, N.Y.

First wide range diamond-and-sapphire combination delivers frequency response from 30 to 15,000 cycles. Tracks all 3 speeds at 6 to 8 grams

High fidelity performance of custom quality—at the lowest price in G-E history—that sums up what audio engineers at Electronics Park have achieved with this latest de luxe addition to the General Electric cartridge line.

The replaceable stylus is of the famous double-twist design. A total of *six* damping blocks filter out harmonic distortion, needle talk and needle scratch. There are no moving parts in this cartridge—nothing to wear out. Remember—when you replace a stylus assembly in a G-E pickup, you replace every component that is affected by age. A new stylus assembly means, in effect, a new pickup.

Ask your G-E dealer about the Golden Treasure cartridge, or write us for the nearest source of supply. *General Electric Company, Electronics Park, Syracuse, N. Y.*

You can put your confidence in—

GENERAL ELECTRIC

SEND FOR THESE NEW CATALOGS!

General Electric Company
(Section 382)
Electronics Park,
Syracuse, N. Y.

Please send me the items checked:

☐ Phono Accessory Catalog ☐ Loudspeaker Catalog
☐ Wide Range Stylus Folder

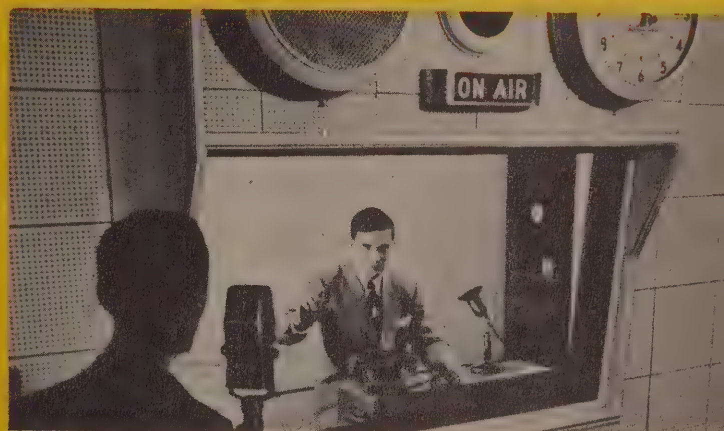
NAME..

ADDRESS..

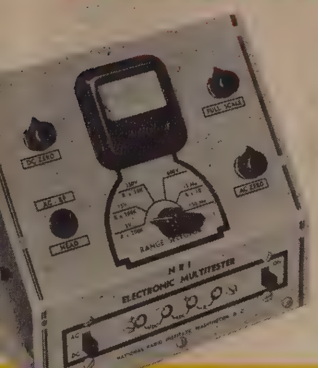
CITY..............................STATE..........................

E. SMITH
resident
onal Radio
nstitute
ington, D. C.

I Will Train You at Home
for Good Pay Jobs, Success in
RADIO-TELEVISION



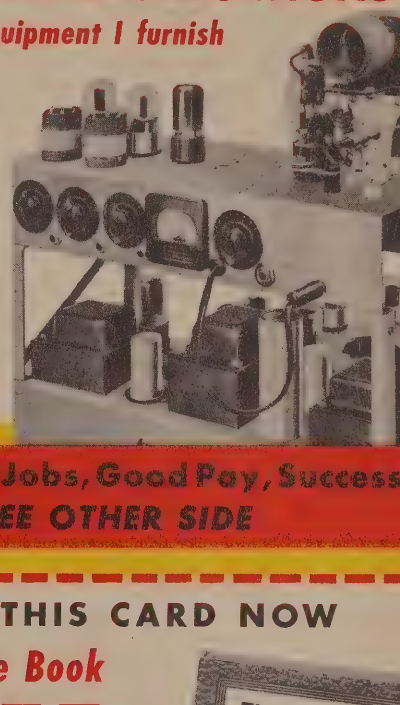
YOU LEARN SERVICING
by practicing with equipment I furnish



You build valuable Multitester (at left) as part of my Servicing Course. You use it to make many tests, get practical experience, make EXTRA money fixing neighbors' radios in spare time. Many of my students earn $5, $10 a week extra while learning. I send you many other kits too. You build a modern Radio. You build many circuits common to Radio and Television. All equipment is yours to keep. Read about and see other equipment in my free book. Mail card below.

YOU LEARN COMMUNICATIONS
by practicing with equipment I furnish

As part of my Communications Course I send you kits of parts to build the low power broadcasting transmitter shown at right and many other circuits common to Radio and Television. You use this equipment to get practical experience putting a station "on the air," performing procedures demanded of Broadcast Station operators. I train you for FCC Commercial Operator's License. Mail Card for Sample Lesson and 64-Page Book. FREE!



There are Good Jobs, Good Pay, Success in Radio-TV! *SEE OTHER SIDE*

TELEVISION *is Today's Good Job Maker*

n 1951 over 15,000,000 homes had Television sets, more are being sold every day. 108 TV stations are lready operating, over 1800 are now authorized and many hundreds are expected to be on the air in 953. This means new jobs, more jobs and better ay for trained men. The time to act is NOW! Start earning Radio-Television servicing or communica-ions. Want to get ahead? America's fast growing ndustry offers good pay, a bright future and ecurity. Cut out and mail card now. J. E. Smith, President, National Radio Institute, Washington, D.C.

CUT OUT AND MAIL THIS CARD NOW
Sample Lesson & 64-Page Book
Both FREE

This card entitles you to Actual Lesson on Servicing, shows how you learn Radio-Television at home. You'll also receive my 64-Page Book, "How to Be a Success in Radio-Television." Mail card now!

NO STAMP NEEDED! WE PAY POSTAGE

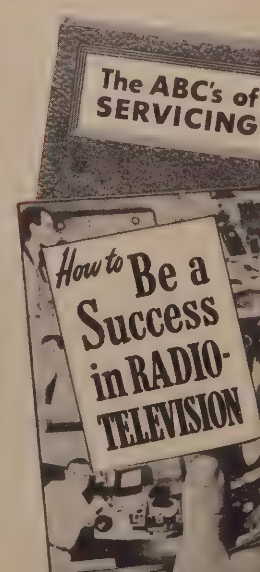
Mr. J. E. SMITH, President,
National Radio Institute, Washington 9, D.C.

Mail me Lesson and Book, "How to Be a Success in Radio-Television." (No Salesman will call. Please write plainly.)

NAME.................................AGE.....

ADDRESS.................................

CITY....................ZONE....STATE.......



A

neral offices will be retained as a rehouse.

Kaiser Manufacturing Corp., Willow n, Mich., a subsidiary of Kaiser-azer Corp., took its first step into e electronics field with the establish-nt of the Kaiser-Sanders Electronics vision, Nashua, N. H. Sanders As-ciates, Inc., Waltham, Mass., sub-sed space from Kaiser and moved its search and development laboratories the new facility.

Raytheon Manufacturing Co., Walt-m, Mass., gave the public an oppor-nity to inspect its South Quincy, ass., receiving tube plant at an "open

ayor Henry A. Turner of Waltham, ass., flanked by Raytheon officials, rmally opens company's new building.

use" marking the Raytheon Tube vision's 30th year of operation. The mpany also dedicated its Seyon Street nt in Waltham which will be used the Research Division in carrying the company's $2,000,000 transistor ogram.

Galvanic Products Corp., New York ty, established a new plant at Valley ream, N. Y., for the manufacture of enium rectifiers, complete rectifier uipment, and allied components.

Sarkes Tarzian Rectifier Division ded approximately 3,000 square feet its facilities in Bloomington, Ind., research and engineering work.

The Gabriel Laboratories has been ablished as a separate division of e Gabriel Co. The Laboratories, rmerly the Engineering Department Workshop Associates, will serve as e research and development center all Gabriel divisions.

Parkside Wire Co., Chicago, recently-rmed wire and wire products manu-cturing firm, expanded its facilities include industrial and jobber sales.

Mercury Electronic Co., Red Bank, J., was recently founded by Andrew unchak, Jr., formerly with Electronic easurements Co. The new firm will anufacture static converters, regu-ted power supplies, specialized elec-onic equipment and other items.

Allied Radio Corp., broke ground for new $2,000,000 building in central icago, which will provide 150,000

square feet of space. It is expected tha the building will be completed by th middle of 1953.

LaPointe-Plascomold Corp., in an other expansion move, transferred al facilities for the manufacture of Vee D-X antennas and accessories fron Windsor Locks to Rockville, Conn.

Amperex Electronic Corp. is now i full operation in its Hicksville, N. Y plant according to an announcement b S. E. Norris, president. The new plant which houses executive, clerical, re search, engineering, and production fa cilities for electronic tubes, is part o the company's long range expansio program.

Telrex, Inc., Asbury Park, N. J., es tablished a new Commercial and Ama teur Array Department which is in ful production on the company's 2-mete "Fishbone" and conical Ham Beams 6-, 10-, 15-, and 20-meter arrays ar scheduled for delivery at an early date

National Video Corp. is consolidatin operations of its four former plants un der one roof in a new 115,000 square foot plant in Chicago, according to a announcement by Asher J. Cole, presi dent of the company. This move wil permit the company to double its out put of TV picture tubes.

Zenith Radio Corp., opened a nev $5,000,000 manufacturing plant in Chi cago for the production of speakers coils, transformers, and other radi and TV components, in addition t Zenith hearing aids and governmen defense materials.

Vaco Products Co., Chicago, manufac turers of "Amberyl" plastic-handl screwdrivers, opened a new branch i Dallas, Texas.

Snyder Manufacturing Co., Philadel phia, designed a new display board fo its line of auto-radio antennas. Mounte on a heavy wood base and finished i red, blue, and green Day-Glo colors, th display is intended for counter use.

Production and Sales

The RTMA announced that 2,318,23 TV sets and 4,838,343 radios had bee produced during the first six month of 1952. A breakdown of the radio pro duction figure showed that 1,831,87 were home sets, 1,543,877 auto radios 777,504 clock radios, and 685,085 port ables.

The RTMA reported the sale of 247, 724 TV picture tubes during May, 1952 compared with 229,250 for May, 1951 The Association further reported 23, 636,484 receiving tubes sold during Ma compared with the May, 1951, figure o 34,074,356. Of the May, 1952, figure 15,807,449 were sold for new equipment 4,178,292 for renewals, and the balanc for export and Government use.

The report pointed out that the pres ent production of military and elec tronic communications equipment com bined with the civilian output of radi and TV receivers exceeds the peak out put of the industry during World Wa

II. The association noted that only 12 manufacturers of electronic equipment and parts failed during the past year, compared with 15 for the previous year. The general outlook for radio and TV was reported as most encouraging, and a rise in TV sales was predicted for 1953.

Business Briefs

. . . **Allen B. Du Mont Laboratories Cathode-Ray Tube Division** established a new warranty policy on replacement picture tubes which extends the coverage from six to twelve months from the date of installation in the consumer's set.

. . . **Radio Craftsmen, Inc.**, Chicago, has appointed authorized service centers in key cities under the direction of Bernard A. Menarik, field engineer. Those already established include: Winters' Radio Lab., New York City; Holbert Electronics, Seattle; Jack P. Plasmier, San Francisco; Los Angeles Radio & TV Maintenance, Los Angeles; and Western Communications, San Diego.

. . . **CBS-Hytron Radio & Electronics**, Danvers, Mass., has begun large-scale operations on semiconductor products. Germanium diodes are already in production. Point-contact type transistors are in the development stage, with production scheduled to begin this year, and will be followed later by junction transistors. The CBS-Hytron laboratory is doing research work on special semiconductor materials.

. . . **The West Coast Electronic Manufacturers' Association** has issued the fourth edition of its Directory which includes a complete alphabetical listing of corporate members with officers and a product index.

. . . **Bulova Watch Co.**, New York City, made a licensing arrangement with Western Electric Co. for the development and production of transistors.

. . . **NEDA** will hold its Third Annual Convention and Manufacturers' Conference in Atlantic City, N. J. September 22 through 25. Hal F. Bersche, manager of renewal sales of the RCA Tube Department, will be one of the principal speakers in the educational program on u.h.f.

. . . **Carbonneau Industries**, Grand Rapids, Mich., manufacturer of radio and TV loudspeakers, celebrated its sixth anniversary at a party sponsored by employees and friends.

. . . **The RTMA** admitted six new members to the association bringing total membership to 340 member-companies. The new members are:— DeJur-Amsco Corp., New York City; Ellar Woodcraft Corp., New York City; Laidman Krispin Co., Chicago; Rego Electric Co., Hoboken, N. J.; Spencer-Kennedy Laboratories, Cambridge, Mass.; and Vacuum Tube Products, Oceanside, California.

—end—

In the CBS-Columbia design laboratories, Al Goldberg takes some important readings with the EICO Model 221 Vacuum Tube Voltmeter and Model 555 Multimeter, as Harry R. Ashley looks on.

Mr. Al Goldberg, Assistant Chief Engineer of CBS-Columbia and Harry R. Ashley, President of EICO, inspecting the use of the EICO Model 221 Vacuum Tube Voltmeter and Model HVP-1 High Voltage Probe at the Sweep Frequency Troubleshooting Position on the CBS-Columbia Television production lines.

For Laboratory Precision at Lowest Cost — the Leaders Look to EICO!

WHY does CBS-Columbia, Inc., one of America's great headline-makers in Television set production, use *EICO* Test Instruments on *both* its new Television production lines and in its design laboratories?

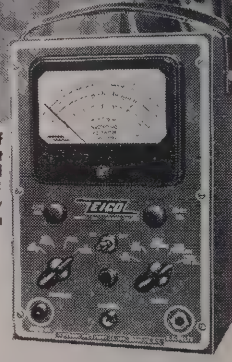
BECAUSE — like Emerson, Tele-King, Teletone, Majestic, and many another famous TV manufacturer coast to coast, CBS-Columbia knows that . . .

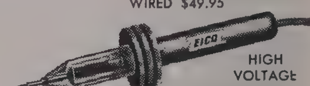
Only EICO Test Equipment delivers All 10 EICOnomical Features!

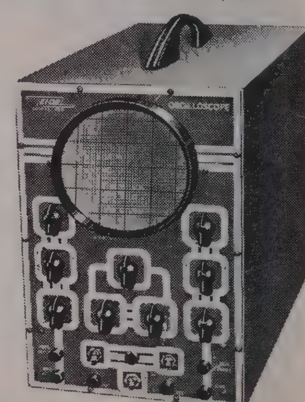
1. Laboratory Precision
2. Lowest Cost
3. Lifetime Dependability
4. Speedy Operation
5. Rugged Construction
6. Quality Components
7. Latest Engineering
8. Super-Simplified Assembly and Use Instructions
9. Laboratory-Styled Appearance
10. Exclusive EICO *Make-Good* Guarantee

Before You buy any higher-priced equipment, look at the EICO line—*in Wired and Kit form!* Each EICO product is jampacked with unbelievable value. *Compare, see EICO instruments today*—in stock at your local jobber—and SAVE! Write NOW for FREE newest Catalog 9-C.

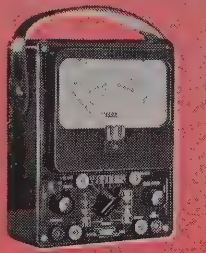
FOLLOW THE LEADERS . . . INSIST ON EICO!


221K VTVM KIT $25.95 WIRED $49.95


HIGH VOLTAGE PROBE $6.95


425K 5" PUSH-PULL SCOPE KIT $44.95. WIRED $79.95

KITS
WIRED INSTRUMENTS

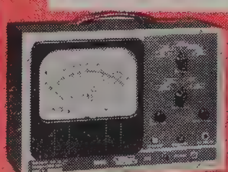

NEW 565K MULTIMETER KIT $24.95 WIRED $29.95 20,000 ohms/volt

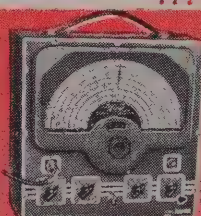

320K SIG. GEN. KIT $19.95. WIRED $29.95

322K SIG. GEN. KIT $23.95. WIRED $34.95

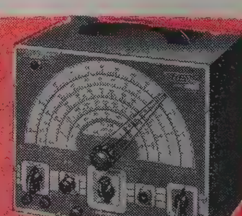

NEW 377K Sine & Square Wave AUDIO GEN. KIT $31.95 WIRED $49.95


950K R-C BRIDGE & R-C-L COMP. KIT $19.95 WIRED $29.95

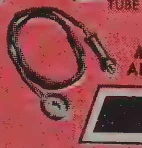

NEW 214K VTVM KIT $34.95 WIRED $54.95 7½" METER

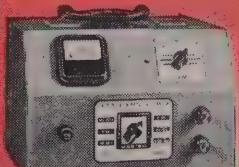

315K DELUXE SIG. GEN. KIT $39.95 WIRED $59.95


625K TUBE TESTER KIT $34.95 WIRED $49.95

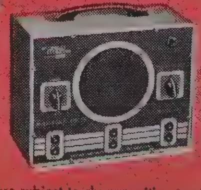

360K SWEEP GEN. KIT $34.95 WIRED $49.95


NEW 536K MULTI-METER KIT $12.90 WIRED $14.90 1000 ohms/volt


NEW CRA PIX TUBE ADAPTOR for above $4.50


1040K BATTERY ELIM. KIT $25.95. WIRED $34.95


1171K RES. DECADE BOX KIT $19.95 WIRED $24.95


145K SIG. TRACER KIT $19.95 WIRED $28.95

EICO Reg. U. S. Pat. Off.

ELECTRONIC INSTRUMENT CO., Inc.
84 WITHERS STREET, BROOKLYN 11, NEW YORK

Prices 5% higher on West Coast. Due to unstable conditions, prices and specifications are subject to change without notice.

Status Of European Television

. . . Why European Television lags behind . . .

By HUGO GERNSBACK

SEVERAL months ago the writer visited France, Belgium, Switzerland and England for a five-week study of European radio, electronic and television conditions.

During our stay, we conferred with a number of radio-electronic leaders of the respective countries in order to gain a first-hand impression, particularly of television conditions.

In Paris we had been invited as the sole speaker before the *Syndicat National des Industries Radioelectriques*, the equivalent of our own RTMA—Radio-Television Manufacturers Association.

During our talk—and the subsequent period when the assembly of French engineers questioned us on various American TV and radio-electronic aspects—it was ascertained that in order to buy a TV set, the American skilled radio worker requires 3 weeks' labor to pay for a modern, medium-range price TV receiver (this was calculated at an average hourly rate of $1.83 per hour, and a 40-hour week). The French engineers immediately pointed out that a parallel French worker requires *a period of some 30 weeks' labor to pay for a comparative set.* We noted later in England that British radio workers require about 10 to 13 weeks' labor to pay for a comparative TV receiver.

Without trying to oversimplify American versus European economics, we believe that our study points to the reason why in the U.S. we have today 18,000,000 TV receivers against England's 1,500,000, France's 18,000, and Switzerland's only a few thousand.

While inspecting several representative European TV and radio factories, and talking with a number of manufacturers, it soon became plain that:

(1) The European radio worker is first, and foremost an artisan. Hand work still leads—fast, machine mass-production in many instances is frowned upon by manufacturers who (a) can't afford to fully mechanize their plants, (b) are afraid of mass strikes by the workers who think that mechanization would throw too many out of work. Therefore, while the European worker's wages are from 2 to 5 times less than those of the comparative American worker, the time to turn out a European TV set, due to slow hand work, nevertheless is many times that of an equivalent American set.

(2) Post-war European taxes are so high and so involved that even with full mechanization, it is doubtful that, even in the forseeable future, the European worker could ever buy a TV set with 3-weeks' wages, or even 6.

Hence TV progress in continental Europe, as far as mass penetration of TV sets into the population is concerned, seems very remote.

As to the technical picture quality, European TV in general is not far behind our own. With no commercials on European TV, the program quality is often better than ours—programs are usually much better and longer rehearsed, unhurried, and consequently the finished product on the screen is often more relaxing to the viewer.

Yet—TV being mostly government-owned—the European programs are often overlong and frequently lag badly. Furthermore, each country broadcasts on a single frequency so there is naturally no choice of programs at a given moment—either you like what is presented at the time, or tune in later to view a program you think will be more to your liking.

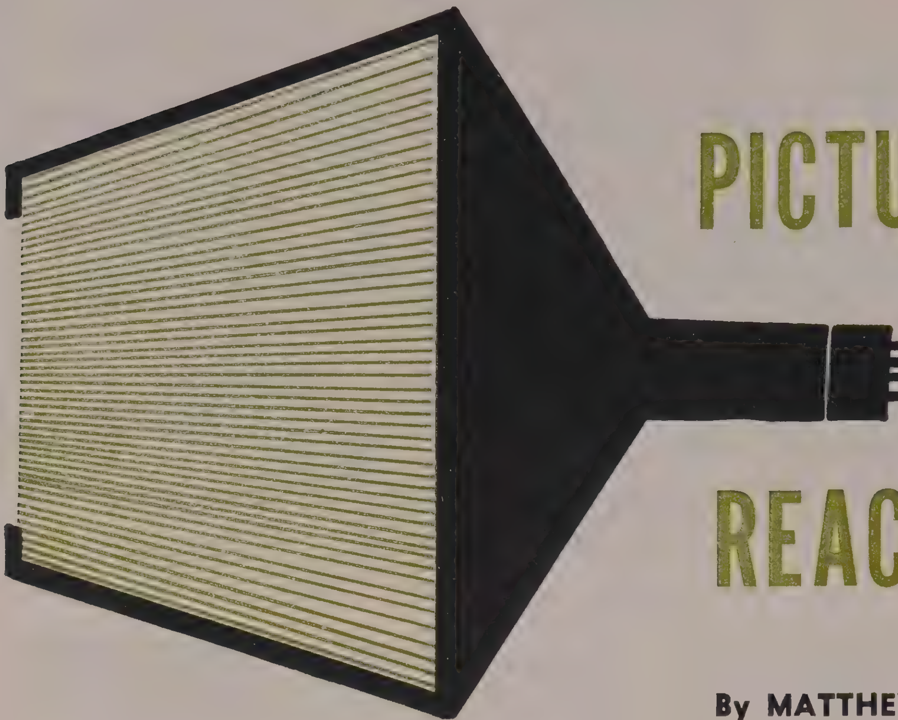
In Europe, the television standards are different from our own. Where we have 525 lines and 60 fields per second, in France they have 441/819 lines and 50 fields, while in England the standard is 405 lines and 50 fields. In France, the French government—which owns all radio and TV transmitters—has so far not been able to allot sufficient funds, and in consequence the progress has been slow. While the quality of the French TV emissions are not much behind our own, hardly any money at all has been spent on studio equipment or programs. These conditions are now about 10 years behind the times, while at the main studio, if such it can be called, there are no modern facilities whatsoever for the performers. This probably will be remedied as the French economic conditions improve.

On the other hand, the quality of the British film broadcasts far exceeds our own today. The technicians of the corporation which operates all radio and TV transmitters, have evolved excellent means of high-fidelity film propagation, so much so that *their film broadcasts now far exceed in quality their live ones!* As one of the chief technicians of the BBC (British Broadcasting Corporation) put it to us, "We are now trying very hard to make our live broadcasts as good as our filmed ones."

This to an American technician sounds incredible, for in the U.S. exactly the opposite conditions prevail. The reason for this progress is that the English technicians have evolved a very high standard of technical perfection and know-how in all their film transmissions. American TV broadcasters would do well to inform themselves of the English progress in this sphere, because as everyone knows, most of our film broadcasts are exceedingly poor.

July 8th also marked the first historical exchange of European two-way international TV broadcasts. France and Britain now exchange daily TV programs routinely. At the point of origin, announcers who must speak both English and French perfectly, explain the features presented so that listeners in both countries can follow the various programs without difficulty. As television standards in France and England differ greatly, it would not be feasible to broadcast and receive the two countries' programs *directly*. A French TV set could not *directly* receive a British program, or *vice versa*—the result would be a blur on the screen.

The problem was solved as follows: When the French picture arrives on the London BBC special picture tube, a British television camera placed in front of it, simply views the incoming picture on that tube, *then* broadcasts it over the BBC transmitter. In this process, less than 2% is lost in quality.



PICTURE-TUBE TESTERS, REACTIVATORS

By MATTHEW MANDL

THE television service technician needs some means of checking picture tubes in order to avoid costly mistakes. He cannot always rely on the symptoms that appear on the screen. What appears to be the effect of a bad picture tube may actually be caused by a faulty circuit elsewhere.

A negative picture, for instance, often indicates a defective picture tube. It could also be caused by excessive signal, interference from another receiver, a faulty a.g.c. system, or other troubles in the picture stages. A washed-out picture which lacks brilliancy may be caused by a bad picture tube, but power-supply trouble or incorrect grid-cathode voltage relationships can produce the same effects.

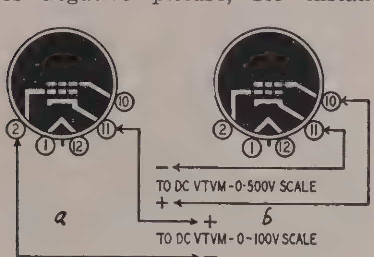


Fig. 1—(a) Connections for measuring picture-tube grid bias. Voltage should increase smoothly as brightness control is turned from maximum to minimum. *Note meter polarities.* (b) Checking accelerator-grid voltage. See text for value.

On the other hand, a bad picture tube may imitate brilliancy-control troubles, degeneration in video amplifier stages, or defects in the contrast-control and a.g.c. circuits.

No wonder the technician is apprehensive about diagnosing a particular defect as a poor picture tube. An error in diagnosis would mean considerable trouble in removing the old tube and installing a new one. If the new tube does not help, additional measures still have to be taken after replacing the old picture tube.

Static tests

Generally speaking, two types of tests can be used to find out if the picture tube is to blame. One is the static test. Remove the picture-tube socket and test for the presence of the various voltages. If the tube does not light, measure the a.c. voltage across the heater pins (1 and 12 on modern *electromagnetic* tubes). With the v.t.v.m. on a d.c. scale, take a reading between the cathode and control-grid pins as shown in Fig. 1-a. The grid pin should show a negative voltage ranging from a few volts to over 60 volts when the brilliancy control is turned from maximum to minimum.

Next, measure the voltage at the accelerator-grid socket terminal as shown in Fig. 1-b. This should be about +250 volts for most 12- and 14-inch tubes. With larger tubes 300 volts or more would be normal. Use a scope to check the presence and amplitude of the composite video signal, because insufficient signal contributes to poor contrast and washed-out pictures. Set the scope sweep frequency at 30 cycles and connect the vertical input leads to pin 2 and pin 11 of the picture-tube socket. You should see the type picture shown in Fig. 2. With a calibrated screen you can read the peak-to-peak voltage as well as observe the waveform.

The Pix-eye

This type of static test can be made quickly with commercial units like the "Pix-eye" shown in Fig. 3. One end is fitted with a standard diheptal tube base, which plugs into the picture-tube socket. The twin-beam electron-ray indicator at the other end shows whether normal operating voltages and composite video signals are present. Normal heater voltage lights the filament

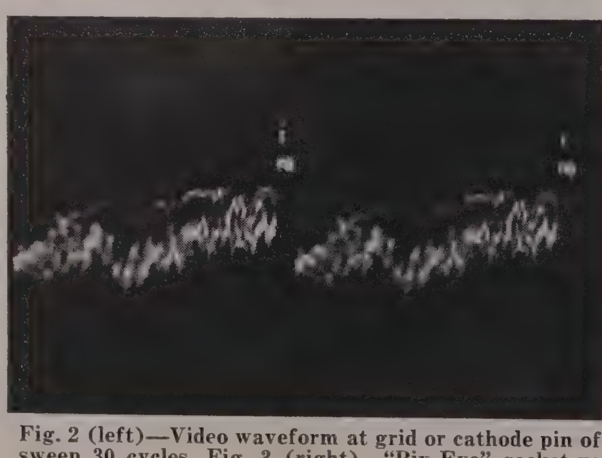


Fig. 2 (left)—Video waveform at grid or cathode pin of picture-tube socket. Scope sweep 30 cycles. Fig. 3 (right)—"Pix-Eye" socket-voltage and signal checker.

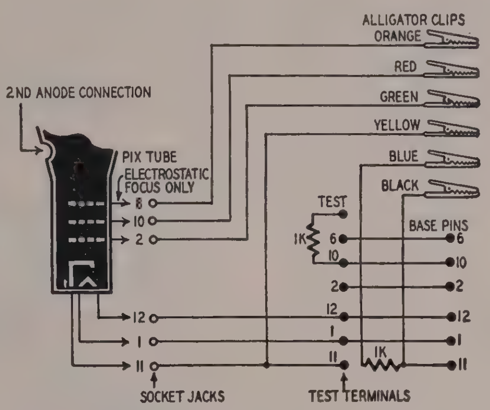


Fig. 5—EBCO Dynamic Analyzer circuit.

and REJUVENATORS

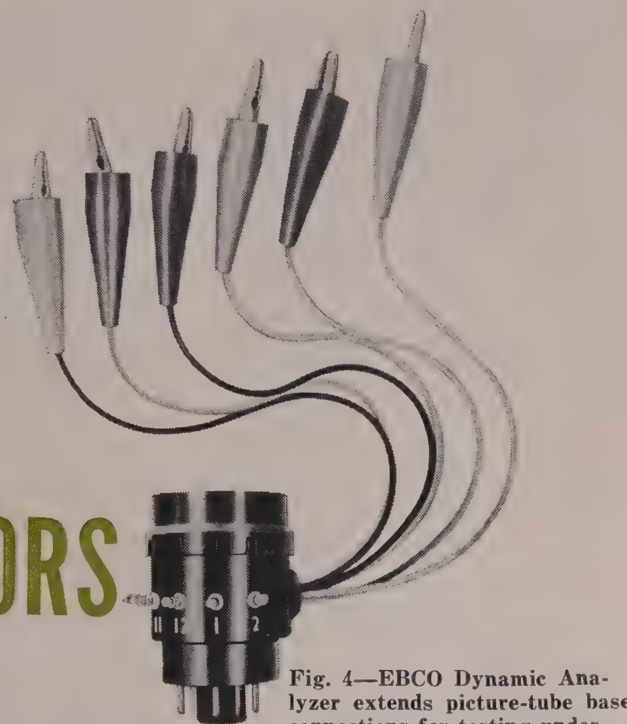


Fig. 4—EBCO Dynamic Analyzer extends picture-tube base connections for testing under normal operating conditions.

to a steady glow; the fluorescent screen glows if the accelerator voltage (pin 10) is O.K.; One beam should vary in area as the brightness control is rotated. With a signal coming through the receiver, varying the contrast control should change the area of the other beam. Video modulation is seen as a fuzzy border on the beam.

With the socket off, check at the picture-tube base pins for filament continuity, and shorts or leakage between tube elements.

The only sure method of checking the high voltage is to measure it. Drawing an arc by holding the terminal near the chassis is not an accurate way to find out how much voltage you have. Often a healthy spark can be obtained with only 9,000 volts, when the voltage actually should be 12,000 or 14,000 volts for best results with the picture tube in use.

Drawing an arc to the chassis will overload the high-voltage rectifier, decrease its emission, and shorten its useful life. If a spark test must be made, do it at the high-voltage receptacle on the picture tube. Here, at least, you are creating an arc at the point where the voltage would normally be applied.

The foregoing procedures are based on the process of elimination. If all tests show normal operating potentials and no shorts or leakages, then the picture tube is probably defective.

Dynamic tests

Static tests may not always tell the whole story because the picture tube is not operating under normal conditions. Sometimes faults will show up only when the tube is connected and voltages are applied. Testing the tube under actual operating conditions is known as "dynamic" testing and there are several commercial models available to facilitate the process.

EBCO Dynamic analyzer

One unit for testing picture tubes under actual operating conditions is the EBCO dynamic analyzer shown in Fig. 4. It is used with a v.t.v.m. to test interelectrode voltages under load as well as to check emission characteristics in relation to cutoff and the accelerating electrode. It also locates open elements and measures leakage between tube elements.

To use the device, remove the picture-tube socket and install the dynamic analyzer between the tube base and the socket. With the receiver on, voltages and waveforms can be checked at the terminals and alligator clips. The instruction manual for the device gives detailed examples of tests to be made and furnishes several charts to facilitate checks. The schematic for this device is shown in Fig. 5.

The NU Videotron

The National Union Videotron picture-tube checker is shown in Fig. 6. A neon bulb shows shorts and open elements. Peak beam current (proportional to light output) is measured on a bridge, with the neon bulb as a balance indicator. The condition of the tube is read directly from the scale of the bal-

Fig. 6—National Union Videotron picture tube checker locates internal defects and shows useful light output.

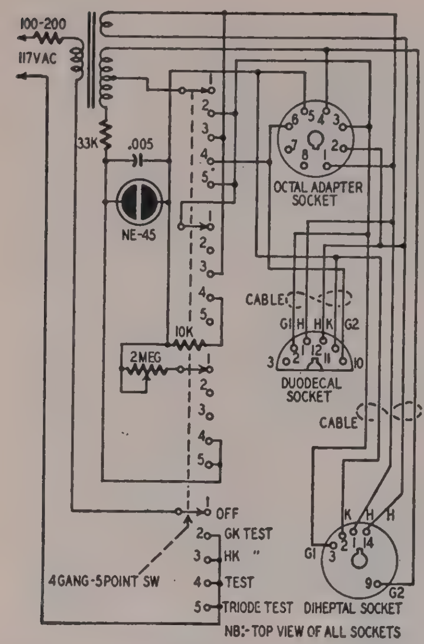


Fig. 7—Circuit of the Videotron tester.

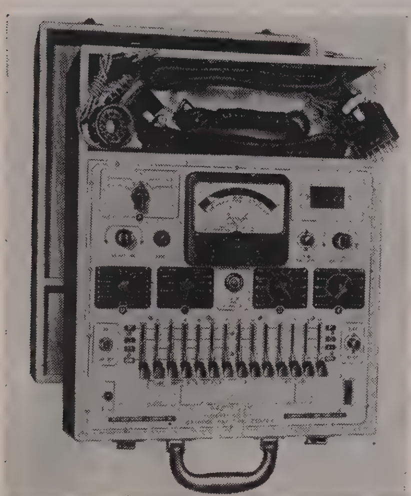


Fig. 8—Precision model CR-30 checks all cathode-ray and picture-tube types.

ancing control. The Videotron checks all electrostatic and magnetic-deflection picture tubes, with either magnetic or electrostatic focus.

Test sockets are provided for picture tubes with diheptal and duodecal bases. These are the types used on over 95 percent of modern tubes. An octal socket is provided on the panel so adapters can be plugged in for tubes with other bases. All tubes can be checked in their original cartons or in the receiver. The schematic of the checker is shown in Fig. 7.

Precision cathode-ray tube tester

A more elaborate and versatile tester is shown in Fig. 8. This device tests not only picture tubes but scope tubes as well. This is the series CR-30 cathode-ray tube tester manufactured by Precision Apparatus Company. It checks tubes by the principle that screen brightness is proportional to beam current. It also checks accelerating-anode and deflection-plate elements. It tests all modern cathode ray tubes, regardless of application.

The basic indicating device is a voltage-regulated and calibrated v.t.-v.m., with a special scale indicating picture-tube quality. A heavy-duty potentiometer is used for precise line-voltage adjustments.

The device locates leakage paths or shorts in the gun structure with a high degree of sensitivity. The actual leakage path is indicated by an RTMA-numbered, 14-element selector system. Open-filament tests are also included in the leakage and short test indications.

The tester measures the electron beam current and checks the critical central-emission area of the cathode. The controlling action of the first grid is also ascertained. Accelerating anodes, deflection plates, and other elements not directly concerned with beam current are tested separately.

The schematic of the CR-30 is shown in Fig. 9. Individual calibrating controls are adjusted and sealed at the factory. The meter circuit cannot be damaged by overloads which might result from picture-tube defects. The entire circuit is fused for protection against shorts.

Reactivators and brighteners

Picture tubes are often discarded for insufficient brightness. If this is caused by low cathode emission rather than defects in gun or screen material, the tube often can be rejuvenated or reactivated.

The cathode is a nickel cylinder to which an emitting element — either strontium oxide or barium oxide—is fused. Through abuse, gas content, or old age, the emission drops below normal and the brilliancy is reduced.

Rejuvenation subjects the tube to the same process used in its manufacture. The filament voltage is raised above normal while low potentials are applied to the gun elements.

Emission current is measured, and when it has reached a leveling-off value the heater voltage is reduced to normal. The heater is "aged" at this voltage for a short time with no voltages applied to the gun structure. After this, the emission characteristics are checked again at several different gun voltages to see if potential changes give proportional emission changes. If they do, the cathode has been decontaminated and its emission restored.

Tubes with low emission also can be operated at slightly higher-than-normal voltages for increased brilliancy. De-

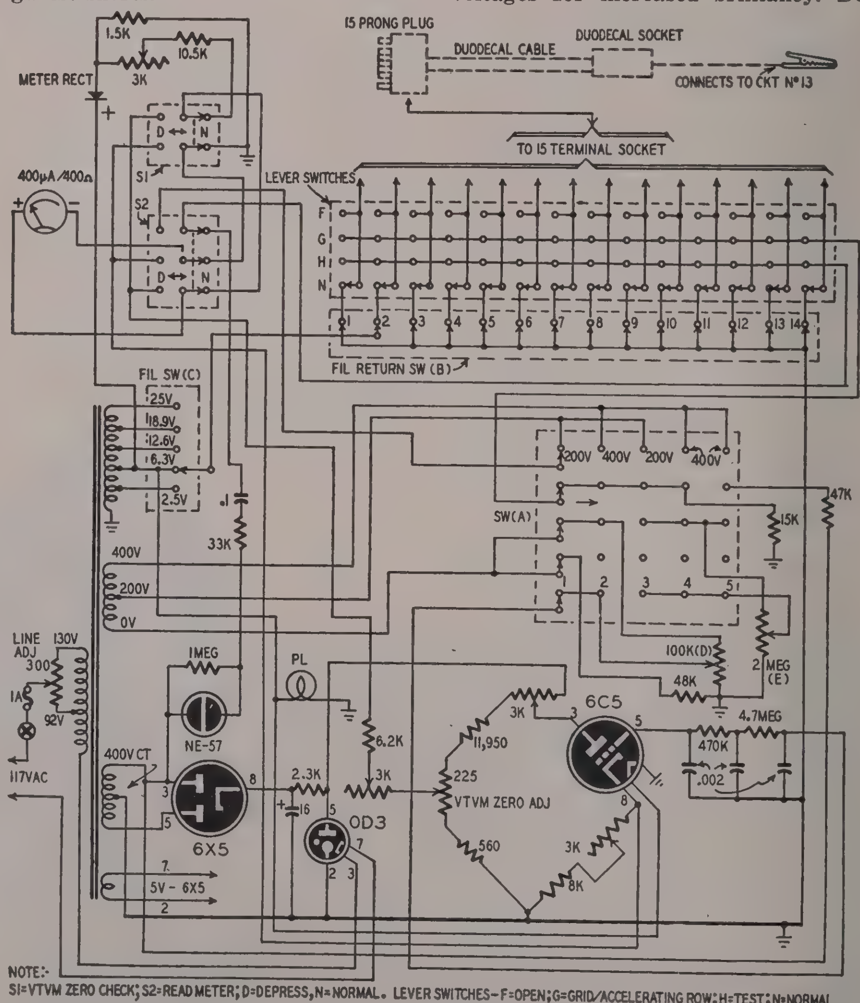


Fig. 9—Schematic of the Precision CR-30 picture-tube tester. Tube quality is indicated directly in terms of brightness. Adapters are available for other bases.

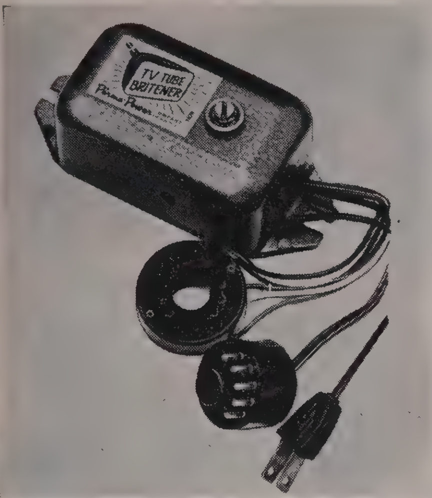


Fig. 10—Perma-Power "Britener" reactivates cathode by raising heater voltage.

vices which do this are called "brighteners." These also help in areas where the line voltage is below normal and drops the voltage on the picture-tube filament below the rated value.

The Perma-Power Britener

One commercial product for restoring brightness in this way is the Perma-Power TV-Tube "Britener" shown in Fig. 10. This unit also isolates the filament circuit of the picture tube from the receiver power supply and will thus relieve some cathode-filament shorts.

The Perma-Power Britener is for tubes with duodecal bases. Installation consists of removing the socket from the picture tube and plugging the Britener base unit into it. The socket provided with the Britener is then placed on the picture tube. The unit plugs into the a.c. line and is controlled by the receiver on-off switch through an internal thermal contactor.

The unit contains a tapped transformer and a switch for selecting any one of three higher-than-normal heater voltages. The leads which formerly went to the picture-tube heater are shunted by a resistor so the device can be used in either series or parallel filament circuits.

The voltage is boosted by the No. 1 or No. 2 position of the switch, according to the degree of rejuvenation needed. Depending on the condition of the tube, brightness may be restored for a period of several months to a year. When the picture becomes dull again, use the third position of the selector. Final loss of brilliancy in this position means a new tube is definitely needed.

The unit can be installed inside or outside the cabinet, and can be used over again in any other installation.

Stay-Brite TV-tube saver

This device (Fig. 11) is similar to the one described above in providing three successively higher boost voltages for the picture-tube heater, as well as a *normal* position. In addition, it has a *low* switch position which applies reduced heater voltage, and may be used to prolong the life of new picture tubes, or where the line voltage is abnormally high. Power is obtained directly from the picture-tube socket of the receiver, eliminating the need for any additional external wiring. Like the previous type, it may be installed permanently in any a.c.-operated receiver using a duodecal-based picture tube, or removed and used elsewhere as required.

The Crest Labs rejuvenator

Another rejuvenator which can be used in the same way is shown in Fig. 12. This one is manufactured by Crest Laboratories. It has a fixed output slightly higher than the normal voltage for the picture tube heater. It is also installed in the receiver cabinet. The base of the brightener is attached to

Fig. 11—"Stay-Brite" picture-tube reactivator has 5 heater-voltage positions.

the picture tube socket, while the brightener socket goes to the picture tube base. When it has outlived its usefulness, it can be used again on other receivers.

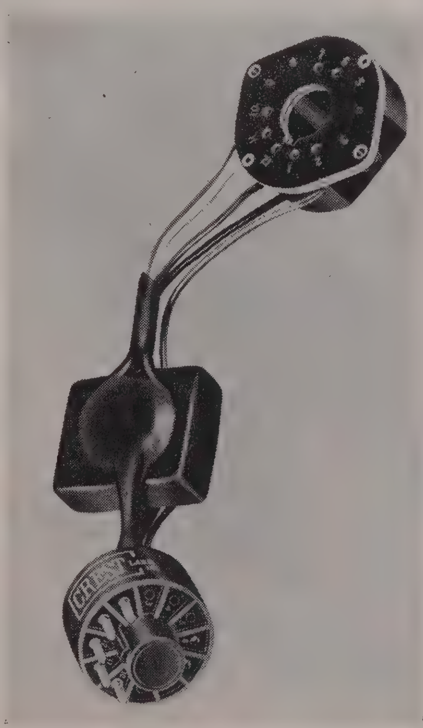


Fig. 12—Crest Labs.' heater-boost rejuvenator needs no a.c.-line connection.

Tubes with diheptal (14-pin) or other bases can be rejuvenated in the same way with some additional wiring. Disconnect *only the heater leads* from the *receiver picture-tube socket* and solder a spare socket contact to the end of each lead. These contacts can then be slipped over *pins 1 and 12* of the *rejuvenator plug*. Two new heater leads are then soldered to the *receiver socket* terminals with phone tips at the open ends. The phone tips are then inserted in terminals 1 and 12 of the *rejuvenator socket*. Be sure to check if one side of the heater is grounded or connected to the picture-tube cathode, and make the interconnections follow the same arrangement.

Don't attempt this on a Philco model 48-700, or any other receiver in which the picture-tube heater or cathode is more than about 150 volts above or below ground potential.

Tester-reactivators

Several companies furnish units which serve as both picture-tube testers and reactivators. The one manufactured by Transvision is shown in Fig. 13. A similar model is also manufactured by the Electronic Beam Corp. who make the EBCO dynamic analyzer shown in Fig. 4. These units check picture tubes by measuring cathode emission, locating shorts between elements, and indicating high-resistance leaks up to 3 megohms.

Fig. 13—Transvision tester-reactivator.

Tubes with low light output can be rejuvenated without removing them from the set. A neon bulb indicates when the reactivating process is completed.

None of these rejuvenating devices will be effective if there are internal shorts, damaged screen material, or other defects in the tube. Check the tube first for these defects. If the only trouble is low cathode emission, try rejuvenation to increase the useful life.

Many other makes of picture-tube reactivators and testers are available now and new ones are constantly appearing on the market. The fact that they are not described or mentioned individually is due only to space limitations.

—end—

Why you get it and what to do about . . .

EYESTRAIN FROM TV

By GEORGE E. ROW

THE next time a customer complains of eye-strain from watching television, give him the following instructions:

1. Turn on more lights in the room while you watch TV.
2. Reduce the brightness setting of the receiver.
3. Move farther away from the picture—and look away from it frequently.
4. Adjust the focus for greater line thickness.
5. Reduce the height of the picture.

To understand eye-strain from TV one must first understand the mechanism of vision. The eye is a camera which focuses an image of the scene being viewed on a light-sensitive mosaic covering its rear inside surface. Each element of this mosaic reports to the mind the amount and nature of the light falling on it. The interpretation which the mind places on the whole mass of reports coming to it from the individual elements constitutes *vision.* The elements are very small—as indicated in Fig. 1. An individual element receives the light coming from a square measuring one thirty-second of an inch on a side held at a distance of 10 feet. The individual elements function best when the quantity of light reaching them in a given time is held within certain limits. To hold the light within these limits the eye is equipped with an

iris which opens and closes automatically as the *average* brightness of the scene varies. Now, if by some trick we expose the mosaic to light three or four times stronger than the average for which the iris adjusts itself—we should expect eye-strain to result. This is exactly what happens in watching TV.

The face of the picture tube is covered by a phosphor which glows while being bombarded by the beam current and continues to glow even after the bombardment has ceased. Fig. 2 shows how the light from a spot on the screen decays. The *average* brilliance is approximately 27 percent of the maximum. The iris of the eye adjusts to the *average brilliance*, but the individual elements of the mosaic will be bombarded by the *maximum* value of the light, which is over three times the average. This causes the strain—a condition which nature never anticipated. This high ratio of maximum brilliance to average brilliance may be verified experimentally. Stand about twenty feet from an operating receiver and look at a point a foot or so directly above the screen. Then whip the eyes to a point about two feet below the screen, observing what you see on the screen during the transit. (It may be necessary to repeat this several times. Blinking the eyes at the time the move is made will help.) You should see an exceedingly brilliant horizontal bar comprising about a dozen scanning lines. Depending upon the exact instant at which the eyes are moved, the bar will appear at the top, in the center, or at the bottom of the screen.

Understanding the problem will help us find a solution. Boiling it down to a principle it is this: Anything that will reduce the ratio of *maximum* brilliance to *average* brilliance of the scene being viewed will relieve the eye-strain. Since the viewer sees more than just the TV screen, there are several things we can do. First, turn on some more lights in the room. This will brighten the background of the TV picture. The iris of the eye will contract, and the maximum brilliance of the TV screen will have less effect on the eye. (Sylvania has taken advantage of this device in its "Halolight.")

Second, reduce the brightness setting of the receiver. This works from the other direction to reduce the ratio of maximum to average brightness in the scene being viewed.

Third, move farther away from the receiver. Here we are bringing into play another principle. In describing the eye we pointed out that the light-sensitive elements are of finite size. If one sits ten feet from a screen fourteen inches in height, then the individual lines of the picture will correspond to individual light-sensitive elements of the eye—as shown in Fig. 3-a. Since the whole picture is scanned in a thirtieth of a second, the elements of the eye are bombarded with the maximum value of the light some thirty times a second. Now move back to a distance of twenty feet—as indicated in Fig. 3-b. Then the individual element of the eye corresponds to a pair of lines in the picture. With interlaced scanning, each line will be scanned sixty times a second. The elements of the eye are bombarded with the maximum value of the light twice as often. We have doubled the average brilliance of the screen without increasing the maximum brilliance. This has been done at the expense of picture detail—which has been reduced 75 percent by doubling the distance. But if we have a picture which we can watch comfortably—which we couldn't before—then we have gained. Moving back also decreases the irritation of the eye. Although the benefit to be realized from moving back is based on scientific principle, some psychological factors play a part. Moving back tends to make the viewer look away from the screen more often—freeing the elements of the eye momentarily from that whacking they take thirty times a second.

Fourth, adjust the focus so that the lines of the picture blend into one another. This reduces eye-strain but at the expense of picture detail. The effect is quite marked up to the point where the unscanned space between the raster lines is completely eliminated. Little is to be gained thereafter. The principle is not too difficult to understand. Suppose the unscanned space between the raster lines is equal in width to the lines themselves. Then the eye in adjusting to the average brilliance of the scene will adjust to a level only 13.5 percent of the maximum brilliance. The ratio of maximum to minimum brilliance is made approximately 7 to 1. Defocusing until the blank space disappears will bring the eye back to a 27 percent adjustment. (Careful adjustment of the vertical hold control for better interlace helps, too.—*Editor*)

Fifth, reduce the height of the picture. This accomplishes the same result as the defocusing—but it may leave some black strips at the bottom and top of the tube. My experience has been that the customer usually objects to this. About the best that can be done is to advise customers owning old-style Zeniths with round screens to operate them at reduced height setting.

A lot depends on the customer—both as to what you can do to reduce the irritation and as to just how much irritation is produced. Some people can watch TV by the hour. As for myself, after fifteen minutes I'm ready to give it the boot. Apparently some of us can stand a greater ratio of maximum to average brilliance than others. In some cases perhaps you can dig up a projection set for the customer. It seems to me that the persistence of these screens—or perhaps it is because they are operated at greater brilliance—is greater than that of direct-view tubes. Anyway, the old phrase, "I can watch a projection set, but these little sets hurt my eyes," is frequently heard. Maybe it is because the darned things can't be kept in focus.

I have given you some tricks to reduce eye-strain. In the main, the tricks reduce the detail in the picture. The complete elimination of eye-strain is an engineering problem. What we need is a storage principle in kinescopes similar to that utilized in iconoscopes. Then a spot on the TV screen would glow with constant brilliance from one scan to the next and then instantly take on a new value of brilliance—which it would hold until the next scan. The ratio of maximum to average brilliance in the scene would then be reduced to unity—for which nature equipped our eyes. If that cannot be provided, then perhaps a phosphor may be developed which will decay along a cosine curve—rather than along the logarithmic curve. These are the only possibilities I see at present—and they are pretty far-fetched. Until the engineers come forward with a solution, use any of the tricks I have given you that will satisfy the customer.

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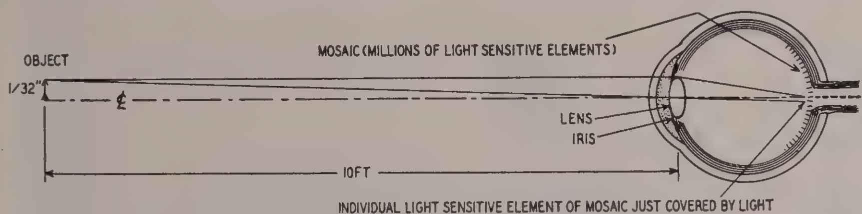


Fig. 1—Each sensitive element of the mosaic receives light from a tiny area.

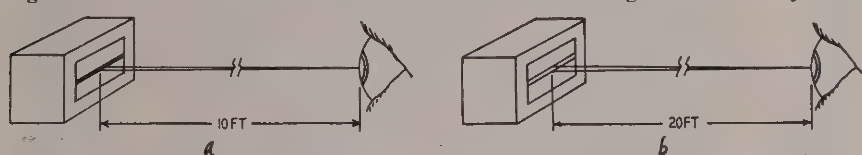


Fig. 3—At double distance each element sees two lines but peak light is cut 75%.

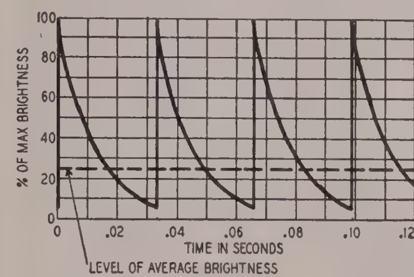


Fig. 2—How light from the fluorescent screen of the picture tube decays after each scanning cycle of the electron beam. The decay follows an exponential curve.

the last word on conVERSION

The author concludes the discussion by pointing out more little-known conversion facts

By M. HARVEY GERNSBACK
Editorial Director

PART II

LAST month we discussed the changes that were necessary in the horizontal sweep circuits of an RCA 8T244 to convert it for use with a 17TP4. Before going into the changes needed in the *vertical* circuits, let's discuss some of the other problems that can come up in the *horizontal* circuits when doing a conversion. We talked about drive and its effect on circuit performance. This a good place to bring up a point not covered last month: If the converted 8T244 receiver is to be operated in an area where the line voltage is below 115, it may be necessary to reduce the size of the series screen resistor R186 below its original value of 6,800 ohms to increase the width and high voltage. But don't reduce it enough to exceed the maximum screen-input rating of the 6BG6-G.

Sometimes there may be enough high voltage and drive, but not enough width. What then? The classical "quick and dirty" remedy (known to all technicians who have done conversion work) is to shunt a small capacitor across two of the secondary taps on the output transformer (usually across the taps recommended for connection of an inductive width control). This will increase the width all right. For example, in this conversion a .005-µf capacitor across taps 5-7 of the RCA 231T1 flyback transformer increased the width about 10 to 15%. *But*—it had its price. The high voltage dropped about 600 volts, which was not too important, since we had plenty. But, much more important is the effect of the added capacitance on retrace time.

Any time you add capacitance, you increase retrace time (flyback time) because you lower the natural resonant frequency of the circuit—and that can cause foldover troubles. Horizontal foldover (on the left side of the screen) has probably caused more grief in conversion work than any other trouble. Yet the remedy is quite simple, provided the original design of the flyback transformer included adequately short retrace time. The converting technician must keep shunt capacitances as low as possible in the flyback circuit.

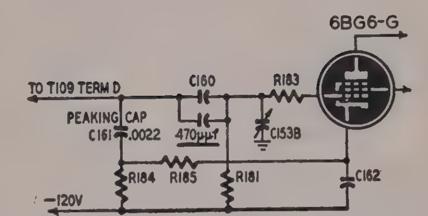


Fig. 1—Peaking circuit in RCA 8T244.

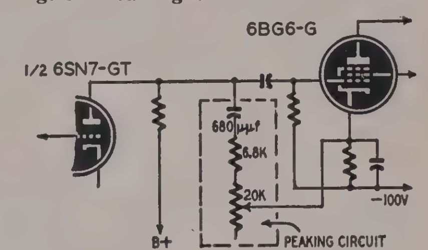


Fig. 2—Horizontal peaking in 630 sets.

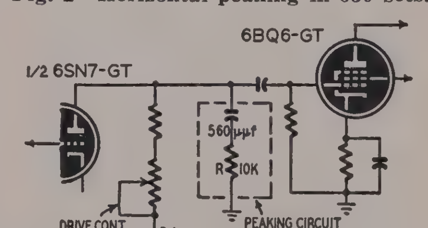


Fig. 3—Drive control affects peaking.

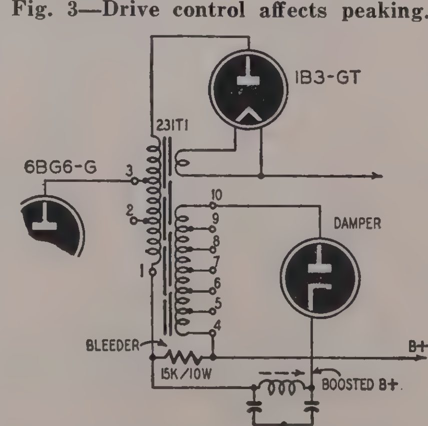


Fig. 4—Added bleeder increases drain on boosted B plus for better linearity.

Another important consideration is that the flyback transformer and the deflection yoke are properly matched to each other, and that the distributed capacitance of the yoke is not excessive. Adding capacitance across the flyback transformer to increase width is a sure way to invite foldover trouble. Points to watch with extra caution for excessive capacitances to ground are the plate lead to the high-voltage rectifier, and the hot end of the deflection-secondary winding.

If we can't increase width by adding capacitance, what are we to do? One simple trick is to *reduce* the size of the blocking capacitor in series with the horizontal yoke winding (0.1 µf in Fig. 1 of last month's article), if this is used. (The value used in this conversion provided greatest width. Increasing this capacitance to 0.5 µf or higher will *reduce* width.)

These changes affect width without adversely affecting retrace. Another point affecting width (and drive and high voltage too) is the value of the horizontal peaking capacitor or resistor-capacitor combination in some sets. Fig. 1 shows the location of the peaking capacitor in the 8T244; Fig. 2 shows the R-C peaking circuit in the familiar 630 chassis. In this circuit the R element is a fixed resistor and a potentiometer used as drive control. It is not

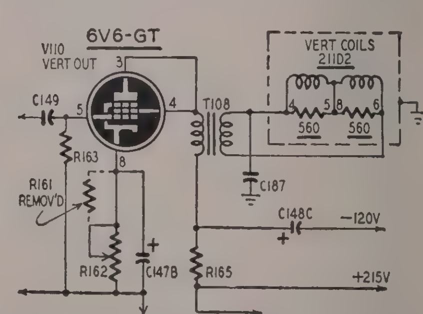


Fig. 5—Removing or shorting R161 gives more range to vertical linearity control.

a true drive control but rather a peaking control. Many other sets use a similar circuit but with fixed values for R and C. In these the drive control is a separate variable capacitor across the horizontal output-tube grid, or a variable resistor in the plate circuit of the horizontal oscillator or discharge tube. See Fig. 3.

Where a circuit similar to Fig. 1 or Fig. 3 is used, it is possible to get maximum peaking (with its attendant increased drive, width, and high voltage) by carefully adjusting the value of C161 (in Fig. 1) or of R (in Fig. 3). Replace R with a potentiometer and adjust for maximum high-voltage output. Measure the value of the potentiometer at peak setting and replace with a fixed resistor close to the measured value. In a circuit such as Fig. 1 try different values of C161 smaller and larger than the original capacitor. Small changes can have a large effect. A capacitor decade is handy. This careful peaking adjustment can make a big improvement. It is particularly valuable when converting to 20-inch or larger rectangular tubes where maximum sweep and high voltage are important.

One last word about foldover. Added capacitance increases retrace time and foldover troubles. By the same token, adding *shunt inductance* will tend to *reduce* retrace time and foldover troubles since the reduction in total inductance *increases* the natural resonant frequency of the system. Suppose a converted set has no width control but has excessive width and foldover. Adding an inductive width control will pull down the width and reduce foldover. The trick is to have extra width to sacrifice for reduced foldover. Any of the methods described previously can be used to increase width in cases of this kind.

Horizontal linearity

Another common conversion problem is poor horizontal linearity. The usual sources of trouble on the right side of the picture are: wrong-value linearity coil for the new flyback, wrong-value or defective capacitors associated with the linearity coil. One frequent cause of poor linearity is seldom mentioned. That is the amount of current drawn from the boosted B plus output of the damper tube (over and above that drawn by the horizontal output tube). Every flyback transformer is designed to supply a certain amount of boost current. If the drain isn't near the recommended design value, linearity will suffer, particularly near the right edge of the picture. The design value for the 231T1 appeared to be about 12 to 15 ma. The original circuit of the 8T244 receiver drew just about this amount from the old flyback transformer so no circuit modification was needed. In some conversions it may be necessary to add a bleeder between B plus and the boosted B plus (as shown in Fig. 4) to increase the drain on the boosted supply and thus provide proper linearity. The peaking adjustment (and the drive setting) have an effect on linearity too, but their effect is generally confined to the left half of the picture.

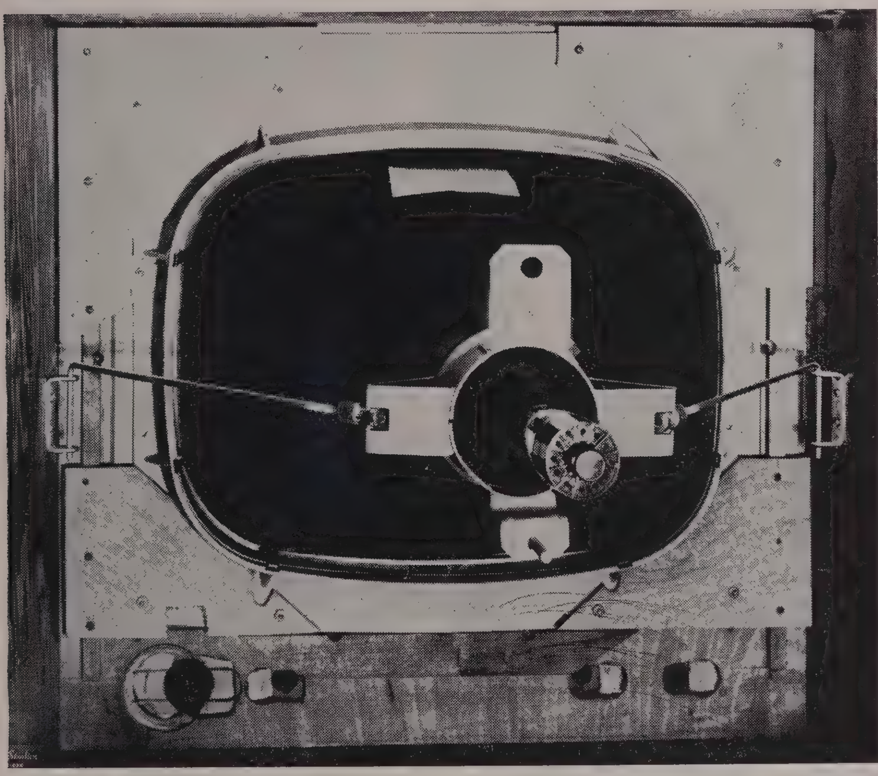


Fig. 6—New tube in 8T244 cabinet. Mask and bracket are for RCA 17-inch receiver.

Picture blooming

Another frequent trouble in conversion work is blooming. The picture enlarges and goes out of focus as the brightness control is advanced. At the same time brightness decreases. Blooming may occur at normal viewing brilliance, making good reception impossible. This trouble is caused by poor regulation of the high-voltage supply as the picture-tube beam current is varied by adjustment of the brightness control.

Several things can cause blooming. (Assuming, of course, that the receiver was checked *before* conversion and placed in A-1 condition, with weak tubes replaced and defects corrected as recommended in part I of this article. It's also assumed that drive has been properly adjusted and peaking is optimum; in short, the set works fine except for blooming.) First of all is a defective picture tube. A gassy tube will draw excessive cathode current. A good rule of thumb is that a normal tube, at normal brightness, will draw a cathode current of 100 to 140 μa. This holds true for most direct-view tubes, *provided* the tubes are operated with normal second-anode and screen voltages for the tube size. (For example, 10,000 and 250 volts for a 10-inch tube; 15,000 and 350 volts for a 17-inch tube; 16,000 and 400 volts for a 21-inch tube). This also assumes that the ion-trap magnet has the proper strength and is properly adjusted and that the beam is correctly centered. The best remedy for a gassy tube is replacement. However in conversion problems we're usually dealing with brand new tubes, so this problem is relatively uncommon.

Suppose we check our tube and find it is normal and that the ion-trap magnet is properly adjusted—but we have blooming. Measure the high voltage at the picture-tube anode, first with the tube face dark (brightness control off), then with the brightness control advanced to normal picture brightness. The high voltage should not vary more than about 5 to 10%. If it does, the yoke is probably improperly matched to the flyback transformer. If the flyback does not have a tapped secondary it may be impossible to improve the situation without replacing the yoke. The new RCA 231T1 with its 7 secondary taps will match any yoke with a horizontal-winding inductance from 8 to 30 mh. Instructions are supplied with the transformer for selecting the proper tap for a given yoke inductance.

If the yoke inductance is unknown you'll have to try various tap arrangements to find the best match. As a rough guide, 50- to 53-degree yokes have an inductance of about 8-10 mh. 66- to 70-degree yokes range from 10 to 18 mh. Direct-drive system yokes usually run about 28 mh. With a proper match, blooming should be negligible at normal picture brightness.

Three final points on horizontal sweep circuits: First, the power-transformer filament winding for the damper tube should have adequate insulation for the higher peak voltages developed in conversion. If it hasn't, the only cure is to disconnect the damper filament

from the receiver supply and install a separate damper-tube filament transformer. Be sure the new transformer has at least 5-kv (peak) insulation between the primary and secondary. If the old damper tube is a 5V4-G it can be replaced with a 6W4-GT and a 6.3-volt filament transformer installed (Stancor P-6134 or Merit P-3074).

The second point is whether or not to use a limiting resistor in series with the high-voltage rectifier filament. If the conversion is to a 53-degree tube (12 to 16-inch) the resistor isn't usually necessary. With a 17-inch tube it's a debatable point. We didn't use one. If you want to insure longer h.v.-rectifier life, use a 2- to 3-ohm resistor. Always use this resistor for larger tubes, where maximum high voltage and width are needed.

The last point is the series-isolating high-voltage resistor described in last month's article—usually a 500,000-ohm to 1 megohm unit. This resistor is especially important when glass picture tubes with external conductive coatings are used. It prevents the picture-tube capacitance from shunting the deflection secondary of the flyback transformer. Use of this resistor is recommended in all conversions.

Other changes in 8T244

When the horizontal-circuit changes were completed, the boosted B plus voltage had increased. Therefore the original circuit connections to pin 10 (the screen grid) of the picture tube had to be modified to keep the screen-grid voltage below 410, the maximum allowable for a 17TP4. Fig. 1 of last month's installment shows the voltage divider arrangement for reducing this voltage.

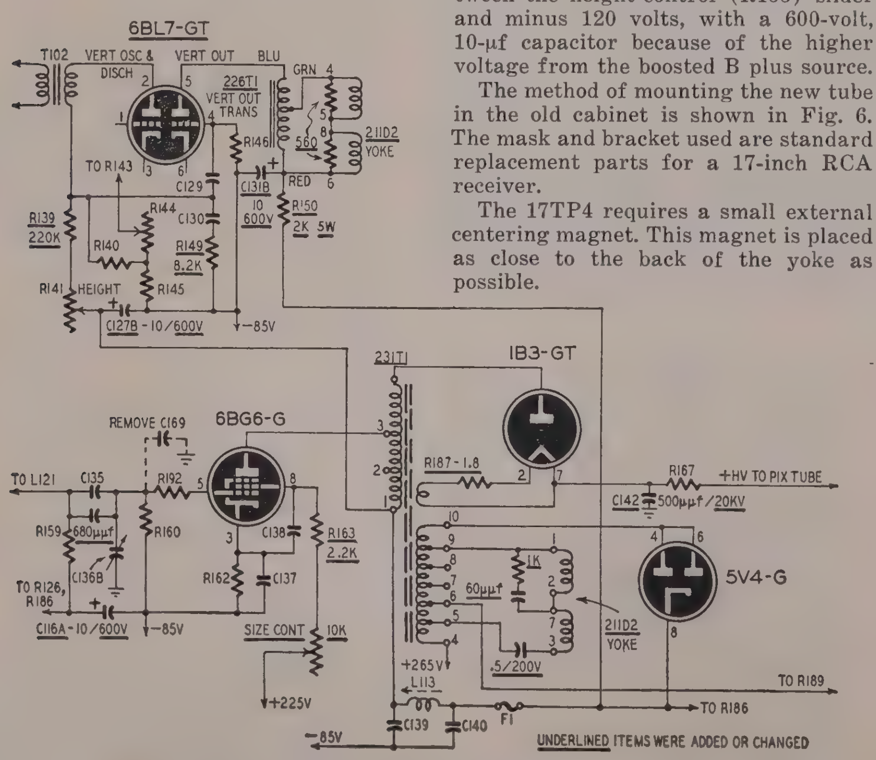


Fig. 7—Diagram shows modifications in the deflection circuits of RCA 730TV1.

It consists of a 750,000-ohm and a 1.5-megohm resistor from the junction of R156 and C146B to ground.

Pin 6 of the picture tube (the focusing electrode) was connected to B plus 215 volts. A refinement would be to connect a 5,000-ohm potentiometer from plus 215 volts to chassis with the slider going to pin 6 of the picture tube for adjustable focus.

Vertical-circuit changes

After the changes described above the set was tested with the new tube. Minor horizontal troubles were easily cleaned up by following the procedures already suggested. But vertical size and linearity were not acceptable. First, the 6K6-GT vertical output amplifier was replaced with a 6V6-GT. Height improved but vertical linearity was still poor. It was best at the minimum-resistance setting of the linearity control, so we shorted out R161, the 2,700-ohm resistor in series with the control. See Fig. 5. Now the control could be adjusted to a point giving good linearity.

(Another solution could have been used for inadequate height: The plate-decoupling resistor R165 for the vertical output tube could have been disconnected from plus 215 volts and connected to the boosted B plus voltage. In this case, C148C would have had to be replaced with a 600-volt unit. It is *not* a good idea to raise the vertical amplifier plate voltage by *decreasing* the value of the plate decoupling resistor. Undesirable coupling between the vertical and horizontal sweep circuits sometimes occurs when this resistor is reduced in size.)

The last change was to replace C146B, the 10-µf filter capacitor between the height-control (R155) slider and minus 120 volts, with a 600-volt, 10-µf capacitor because of the higher voltage from the boosted B plus source.

The method of mounting the new tube in the old cabinet is shown in Fig. 6. The mask and bracket used are standard replacement parts for a 17-inch RCA receiver.

The 17TP4 requires a small external centering magnet. This magnet is placed as close to the back of the yoke as possible.

Converting the RCA 730TV1

An example of another 17-inch conversion is shown in Fig. 7. This shows the circuit changes made in the vertical and horizontal sweep systems of an RCA 730TV1—a particularly difficult set to convert. Circuitwise it is very similar to the Tele-Tone TV209, TV210, and TV249 receivers.

The 231T1 transformer and the 211D2 deflection yoke were used in this conversion too. However, the circuit revisions in the vertical output stage were more extensive, since the original output tube was one section of a 6SN7-GT. This was replaced with a 6BL7-GT, and B plus for the output section was taken from the boosted B plus supply, directly from the cathode of the damper tube rather than from terminal 1 on the flyback transformer. This connection gave the best horizontal linearity.

The vertical output transformer had to be replaced with an autotransformer having an 18-to-1 ratio because of the higher source impedance resulting from the use of boost voltage. Whether or not the vertical output transformer must be replaced in any given conversion depends on the impedance of the vertical windings in the new yoke. (In vertical windings the resistance is the most important factor. Inductance is relatively unimportant because of the low frequency (60 cycles). If the resistance is markedly different from the old yoke windings, you may have to replace the output transformer to get a better match.

Check List on conversion problems

Factors affecting high voltage (assuming all tubes are perfect):

1. High-voltage rectifier filament voltage.
2. Drive voltage (peak-to-peak amplitude).
3. Peaking-circuit adjustment.
4. Receiver B supply voltage.
5. Boosted B supply current drain.
6. Length of lead to plate cap of high-voltage rectifier.
7. High-voltage capacitor leakage.
8. Shunt capacitance across deflection secondary winding.
9. Condition of linearity-control bypass capacitors.
10. Horizontal-amplifier screen power input.

Factors affecting width:

1. Series capacitor blocking d.c. from horizontal yoke windings. (Small values give greatest width.)
2. Drive voltage (peak-to-peak amplitude).
3. Peaking-circuit adjustment.
4. Added capacitance across deflection-secondary taps. (Also affects retrace.)
5. Receiver B supply voltage.
6. Boost voltage.
7. Horizontal-amplifier and damper-tube condition.
8. Value of width control (if used).
9. Condition of linearity-control bypass capacitors. (Leaky capacitors affect

left side of picture; open capacitors affect right side.)

Factors affecting linearity:

1. Boost-supply current drain (12 to 15 ma in addition to horizontal-amplifier plate current with 231T1 flyback transformer).
2. Inductance of linearity coil and *ratio* of linearity bypass capacitors.
3. Drive waveform.

Factor affecting brightness:

1. Ion-trap magnet adjustment.
2. Picture-tube screen-grid voltage (300 volts minimum for 17-inch tube).
3. Condition of picture tube. (Gassy tube draws too much current and reduces high voltage.)
4. Magnetic-focus tubes: Alignment of yoke and focus coil (or magnet) on neck. In case of shadow trouble wedge the yoke in correct position with paper shims before installing focusing device. (Use low-voltage electrostatic-focus tubes wherever possible.)

Factors affecting h.v. regulation:

1. High-voltage rectifier condition and filament voltage.
2. Value of high-voltage isolating resistor.
3. Match between yoke and deflection secondary.
4. Value of charging resistor in voltage-doubler circuits.

Factors affecting horizontal retrace time:

1. Capacitance (stray or inserted) across flyback secondary increases retrace time, emphasizes left-hand foldover. Inductive shunt-type width control reduces secondary inductance, reduces retrace time and left-hand foldover.
2. Length and dress of high-voltage rectifier plate-cap lead. (Keep short and dressed away from other components and chassis to reduce capacitance to ground.
3. Yoke connected to wrong deflection-secondary taps.
4. Phasing of feedback circuits inductively or capacitively coupled to flyback secondary.
5. Omitting high-voltage isolating resistor or using one whose resistance is too low. (Shunts picture-tube capacitance across entire secondary system.)

—end—

HAM-BAND INTERFERENCE

Interference from amateur transmitters in the new 21-21.45-mc band should not affect older TV receivers with sound i.f.'s 21.7 mc or higher. These include Andrea, Belmont, Cascade, Crosley, Du Mont, Firestone, Hallicrafters, Philco, Sheraton, Sightmaster, Stromberg-Carlson, and Transvision. (See RADIO-ELECTRONICS for January, 1952.) Newer receivers with 44-mc i.f.'s might pick up second harmonics of the new band, but in these cases the fault would lie with the amateur, who is required by law to eliminate harmonics of the transmitter frequency.

TV DX IN SEPTEMBER

The early fall is one of the low periods of the year for sporadic-E skip, the phenomenon that most of us think of as synonymous with dx, so the viewer who is looking for signals from more than a few hundred miles away will almost certainly be doomed to disappointment during September. There may be a few scattered dx openings, but they will be short, and signal levels and geographical extent will not compare with the summer sessions.

This is a fine time of year for tropospheric bending, however, and the observer who has a sensitive receiver and a good antenna system will find it well worth while to watch both low and high channels carefully. The early morning hours will show the strongest signals ordinarily, and the many stations now transmitting as early as 7 am make it possible for the early riser to make interesting observations. Cool nights following fair, warm, days, a weather pattern common over the northern half of the country in September, will also provide higher-than-average signal levels in the evening hours.

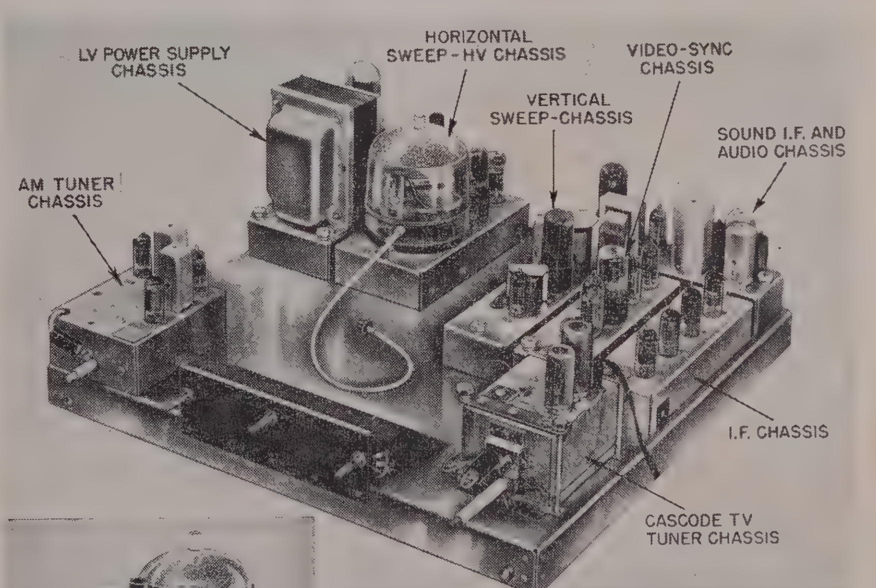
Reception of signals from 1,200 miles or more away, such as was possible frequently during the early summer, is a thrilling experience to say the least, but it is not necessarily proof of superior receiver or antenna performance. The reflection characteristics of the E region of the ionosphere are such that low-channel dx signals may be extremely strong, occasionally blocking out or seriously interfering with local stations. Obviously, it doesn't take a hot receiver or a high-gain antenna system to pull in this kind of dx, interesting though such reception may be.

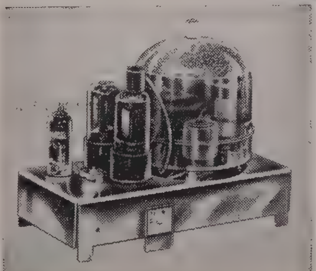
Tropospheric bending associated with weather effects, on the other hand, seldom brings in really strong signals from distant points. Rather, it serves to increase the strength of fringe-area reception, and occasionally brings in signals that are not receivable at all under ordinary conditions. There is little or no skip effect, the signal being receivable over the entire path from the transmitter to perhaps several hundred miles out. Because signals of this kind are seldom extremely strong, good reception of them is almost wholly a function of the efficiency of the receiver and its antenna system.

The higher the frequency the greater is the effect of the fall inversions in increasing the signal strength, a fact not readily apparent to most viewers because of the relatively poor performance of most receivers on the high channels. A really large array (the amount of energy an antenna will intercept is determined by its frontal area, more than by the number of elements) and a low-noise preamplifier designed for good high-band performance may bring in signals on channels 7 through 13 that most viewers never see. The next two months are the best time of the year to try for this sort of thing.

—end—

AIRTIGHT DOME SEALS FLYBACK UNIT





Plug-in TV chassis has new hermetically-sealed h.v. unit. The Setchell-Carlson Unit-ized Chassis 152, in addition to individually removable subsections, now features a dust- and humidity-proof housing for the flyback, h.v., and deflection components. The upper portion of the plastic enclosure is filled with moisture-absorbing silica gel. The dome can be removed for servicing and resealed for full protection.

RETRACE BLANKING IN TV RECEIVERS

By GAIL W. WOODWARD*

D. C. RESTORATION in television circuits has always been a problem. This is emphasized by the large number of lengthy attempts to merely explain the concept. True d.c. restoration is very difficult in view of the poorly-maintained standards for sync-to-video amplitude. In fact, some stations do not even maintain constant sync amplitude. Since most d.c.-restoration circuits use the sync peaks as a reference level, the observed black reference level will vary from station to station.

This problem has been attacked from several directions. One solution is the line-to-line clamping circuit described in the March, 1952, issue of *Electronics,* which solves the problem in a somewhat costly manner. Another approach was found in the complete removal of d.c. intelligence from the picture. Strangely enough, this method worked—it was found that a picture does not need d.c. restoration for customer approval. The eye registers *gradations of brightness* without too much regard for overall intensity. After this factor was discovered, many manufacturers merely removed the d.c. restorer circuit from the receiver. However, some set owners noticed that horizontal lines sometimes appeared in the darker scenes. The disturbing effect of these "white lines" was the only objection to the loss of d.c. picture intelligence. The remaining problem was to eliminate these objectionable lines.

Vertical-retrace blanking

The vertical return trace can be blanked in several ways. The first consideration is the method of feeding video to the picture tube. Some circuits feed video—with positive-going sync pulses—to the picture-tube cathode; other circuits feed video—with negative-going sync pulses—to the picture-tube grid. The latter is more common. If the tube is grid fed, the return trace can most easily be blanked by feeding a positive-going pulse to the cathode. The positive pulse should have a duration equal to the vertical-retrace period, and an amplitude of 50 to 100 volts.

Fig. 1 shows a practical form of cathode-fed blanking. Blanking voltage is derived from the plate of the vertical-output tube through a simple network (shown connected by broken lines). The R-C product (time-constant) of the blanking circuit is made very close to 850 microseconds—short compared to the vertical-sweep period (1/60 second, or 16.666 microseconds), and fairly long compared to the vertical-retrace period (200 to 400 microseconds in most cases). The exact time-constant will depend on the characteristics of the receiver. This figure of 850 microseconds has been found applicable to a great many sets, but will not work equally well in all cases.

The vertical-output waveform (E_p) is shown at the plate of the vertical amplifier. The sweep period is shown as a negative-going sawtooth, while the retrace occurs during the positive-going pulse. The blanking circuit differentiates the vertical-output wave. The resultant waveform appears as a positive pulse at the picture-tube cathode and cuts off the beam current during the retrace period. Since the plate waveform is of very high amplitude (up to 1,500 volts peak-to-peak in some cases), a voltage-divider is used to give about an 80-volt peak-to-peak blanking pulse. In receivers where the vertical output is more or less than 1,500 volts, the value of the 15,000-ohm resistor can be changed accordingly. For example, if the vertical output is 750 volts peak-to-peak, the 15,000-ohm resistor should be changed to about 30,000 ohms. This adjustment can be made without altering the blanking-circuit time-constant value materially.

Where this circuit is being installed in an unfamiliar receiver for the first time use a 50,000-ohm potentiometer in place of the 15,000-ohm resistor, and a 500,000-ohm potentiometer in place of the 270,000-ohm resistor. Start with the 50,000-ohm potentiometer at about one-fourth maximum resistance, and adjust the 500,000-ohm potentiometer for the correct waveform. Then adjust the 50,000-ohm potentiometer for the desired pulse amplitude. Measure the two potentiometers and substitute fixed resistors of equivalent values.

Parts placement is somewhat critical, but if the 270,000-ohm resistor is attached directly to the plate terminal of the vertical-output tube socket with as short a lead as possible, very little difficulty will be experienced. If a long plate-circuit lead is used there may be undesirable radiation.

Fig. 2 shows the effects of incorrect time-constant in the blanking circuit. Fig. 2-a indicates excessive differentiation produced by too-short a time constant. This can be corrected by shunting additional capacitance across the .003-μf capacitor. Fig. 2-b shows the effect of too-long a time constant, which can be corrected by shunting the 270,000-ohm resistor to a lower value. The first waveform will cause a bright bar across the top of the picture; the second will create a dark bar by blanking out the upper portion of the picture.

If the video signal is applied to the cathode, it is advisable to use grid blanking as shown in Fig. 3. Grid blanking requires the application of a negative pulse to the picture-tube grid during retrace. Since the vertical-output transformer (in most receivers) inverts the waveform, the differentiated pulse from the secondary will be negative. The waveforms for Fig. 3 are similar to those in Fig. 1, except for polarity and amplitude. The time constant is not changed but the voltage-division ratio is different. The division ratio for Fig. 3 is 2⅓ to 1 as compared to a ratio of 19 to 1 for Fig. 1. The method of exact adjustment is the same.

(If the transformer does not invert the waveform that appears at the plate side, reverse one pair of transformer leads (either primary or secondary) and reverse the vertical deflection-coil leads.

In some cases it may be desirable to connect a .001-μf capacitor across the 15,000-ohm resistor, as shown in Fig. 3. This capacitor will bypass any horizontal-sweep signal that may be picked up by electrostatic cross-talk between the horizontal and vertical coils in the deflection yoke.

Some receivers use an autotransformer, which does not invert the plate waveform, in the vertical-output circuit. It is not advisable to change the circuit since the desired effect can be obtained with the arrangement shown in Fig. 4. In this case, the grid waveform is used as a signal source for the differentiator circuit. It is important not to load the high-impedance grid circuit; loading is prevented by using a high value of resistance and a small capacitor. The waveforms are similar to those of Fig. 3. and the time-constant can be adjusted in the same way.

The circuit of Fig. 5-a has the advantage of working equally well with either cathode video injection or grid video injection. In this circuit, a single triode (shaper tube) is required to provide a controlled waveform. One section of a 6SN7-GT (or equivalent) is most often used. The blanking voltage, in the form of a negative-going pulse, is applied to the first anode (grid No. 2) of the picture tube.

Fig. 5-b shows the waveforms at the grid and plate of V1. The large signal input develops a corresponding value of negative bias by grid rectification; the tube conducts only during the most positive portion of the input wave. When the input voltage drops below

* Philco Corporation, Philadelphia, Pa.

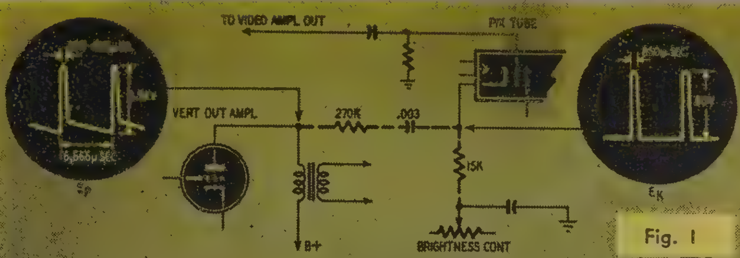


Fig. 1

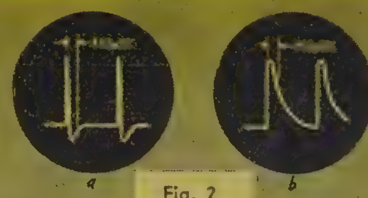


Fig. 2

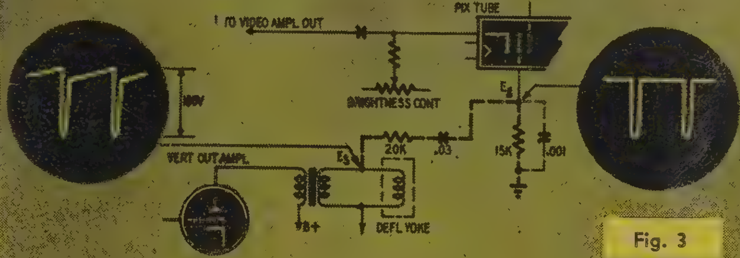


Fig. 3

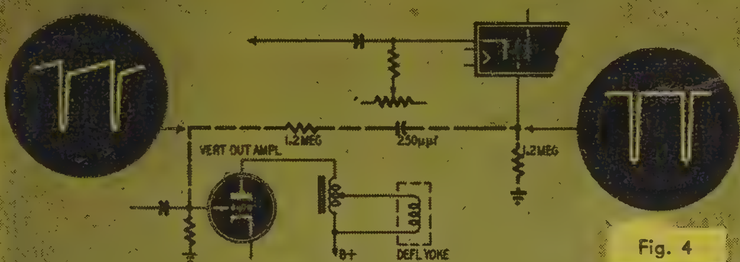


Fig. 4

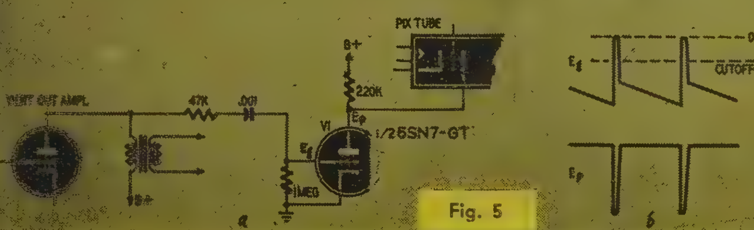


Fig. 5

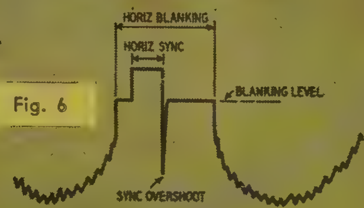


Fig. 6

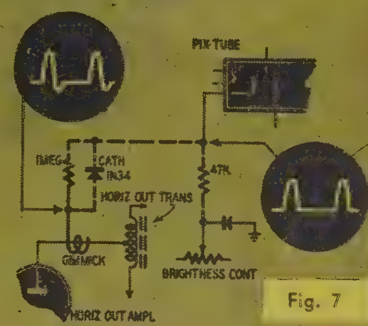


Fig. 7

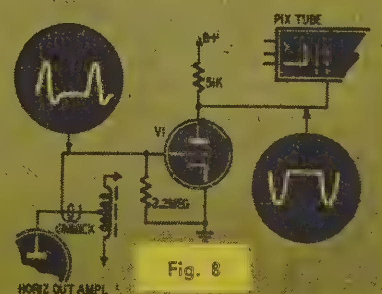


Fig. 8

the cutoff point of the tube, the plate remains at B plus potential. The short conduction pulse during the retrace period drops the plate voltage to a very low value, removing the first-anode potential from the C-R tube.

Horizontal-retrace blanking

Adding horizontal-retrace blanking can cure a common trouble known as sync overshoot which originates in the transmitter. The sync pulse is followed by a narrow reverse spike extending down into the white region. See Fig. 6. It shows up in the receiver as a vertical white bar which can be shifted with the hold control, but cannot be eliminated.

The spike occurs during the horizontal retrace interval. This accounts for the width of the vertical white bar—retrace in the TV set is at such high velocity that the spike is spread out.

One method of eliminating the effect of sync overshoot is to reduce the receiver bandwidth to a point where response to the overshoot frequency is eliminated. This works, but reduces picture quality considerably. The best approach found so far is a horizontal-retrace blanking circuit. The object is to drive the C-R tube so far beyond cutoff that the white-level spike will still not be sufficient to cause conduction.

Fig. 7 shows a successful method for horizontal-retrace blanking. The parts connected by dashed lines are added components. A gimmick is used to couple a small portion of the signal at the plate of the horizontal output tube to the picture-tube cathode; the positive flyback pulse drives it well into the cutoff region. The crystal diode and resistor act as a limiter to prevent the negative overshoot which usually follows the horizontal-retrace pulse from appearing on the screen. (If the horizontal output waveform has no overshoot, the crystal can be eliminated.) The waveform at the cathode is a positive pulse during retrace, and a flat portion during the normal trace period.

If this circuit is overcoupled, it is very easy to burn out the 1N34. A 1N39 or 1N55 will be helpful, but more expensive. Burnout can be avoided if the gimmick is wound while the circuit is in operation and a calibrated oscilloscope used to monitor the pulse amplitude at the cathode of the picture tube. Slowly increase the gimmick capacitance until a cathode pulse of about 50 volts is obtained.

If cathode blanking of the horizontal retrace is undesirable, the coupled pulse can be applied to an inverting amplifier and then fed to the grid. It would also be possible to apply the pulse to an amplifier which has its output connected to the first anode, as shown in Fig. 8. In this case the gimmick coupling should be adjusted until the negative-input swing is below the cutoff point of V1. Final adjustments should be made to give the desired blanking waveform.

Retrace blanking is a very definite necessity in modern TV receivers, and is included—to some degree—in most sets now being produced. Vertical retrace blanking has become almost a standard circuit, but unfortunately horizontal retrace blanking is not widely used.

—end—

TV SERVICE CLINIC

Conducted By
MATT MANDL*

WE receive numerous queries regarding fringe-area reception. Often the question of using the Yagi antenna arises. For this reason we will discuss some of the factors involving Yagis. For those who want to construct their own or who want to shop for a particular type, diameter relationships for obtaining the necessary 300-ohm impedance are given.

The Yagi antenna has considerably more gain than the ordinary television types. A four-element Yagi (Fig. 1) has a theoretical gain of over 9 decibels compared with an ordinary dipole. When a reflector and several directors are added to *any* antenna, its impedance drops appreciably. Thus, if a folded dipole were used for the Yagi, its impedance would drop to 30 ohms and create a severe mismatch with 300-ohm line.

Most manufacturers modify the folded dipole in order to regain the higher impedance. One method is to use different diameters for the fed element and the unbroken element (Fig. 2). The impedance depends on the ratio of spacing to element diameter; examples of the calculated dimensions for 300 ohms are given below:

Unbroken Element Diameter	*Fed Element Diameter*	*Spacing (Center to Center)*
3/4"	3/8"	1.6"
1"	3/8"	2"

These dimensions apply only to the four-element Yagi shown in Fig. 1. If additional directors are added, the impedance will again drop below 300 ohms.

For maximum gain, the spacing between directors should be 1/10 wavelength and the reflector should be spaced from the antenna by 0.15 wavelength. More than one reflector adds little to gain.

It must be remembered that the Yagi has one serious disadvantage. This is the narrow band over which it will work. Usually the Yagi is suitable only for the station to which it is cut. It will not bring in adjacent channels well unless they are much stronger than the station for which the Yagi was designed. Special types, like the twin-driven Yagi, are suitable for two channels but are still not broad-band antennas like the standard biconical types. If additional fringe-area stations are to be received, several Yagis will have to be erected, preferably with separate lead-ins. These can be switched into the receiver as required.

Stacking helps if *each antenna is cut for the same channel.* Half-wavelength spacing is best because it maintains the desired forward lobe and increases gain by an additional 4 db. The stacked array is fed at the center of the connecting bars as detailed in the Television Service Clinic in the June, 1952, issue.

Antenna dimensions

I am stacking Yagi antennas for channel 5 and would like to know if 72.8 inches is the correct measurement for one-half wavelength. Please advise me just how one arrives at the proper wavelength measurement in inches. C. S. W., Pocahontas, Va.

The dimension of 72.8 inches is the proper measurement for channel 5 connecting bars for Yagi stacking. This is a "free-space" measurement and does not apply to transmission lines with insulating material.

For one-half wavelength in feet, the following formula applies:

$$\frac{492}{\text{freq. (in megacycles)}}$$

Because of "end effect" antennas are cut 5% shorter than the length given by the formula. Reflectors are usually 5% longer than antennas, while directors are 4% shorter.

Regulating a.g.c.

I would like to know if it is possible to put a switch in the a.g.c. circuit of an Air King 700 receiver so that I can switch out the a.g.c. when the signal is weak. I live a hundred miles from channel 4. Is there any change that I could make in the circuit of the receiver to increase the gain? L. W., Ravenwood, Mo.

Instead of a switch we recommend that you replace the 4,700-ohm fixed resistor with a 5,000-ohm potentiometer. This will give you control over a.g.c. to prevent overload on extra-strong signals. Fig. 3 shows this control.

We do not recommend any other circuit changes in this receiver. You could improve reception by increasing antenna height and using open-wire or slotted transmission line. Some hints on fringe-area reception were given in the Television Service Clinic in the February, 1952, issue.

Line interference

A Zenith receiver is picking up power-line noise, making the picture jitter sideways. This is more pronounced on a weak signal. What type of filtering can be used to correct this condition? The receiver is located near a high-tension wire system across the road. It does not interfere all the time, but only on occasion and particularly for a weak signal. What type of line filter or other corrective measure can I employ? D. S. Madison, Maine.

Arcing or corona on the high-tension line could cause the severe interference you mention. If such is the case the power company should be notified so that they can take corrective measures.

Try a 0.1-μf, 600-volt paper capacitor across the a.c. power line feeding the receiver. You could also use a Drake, JFD, or Tele-matic ignition filter at the antenna terminals of the receiver. See your local television parts jobber for the various antenna filter units available. Sprague Products Co. also makes a special line filter (0.1-μf, 250-volt a.c. rating), which could be used instead of the 0.1 μf mentioned above.

Improving signal pickup also will help. This means having a good antenna system, as well as a properly-aligned receiver with good parts and tubes.

Jitter and poor focus

In an Admiral model 26R36, chassis 24F1 receiver there is a pronounced vertical flicker. Focus is also poor and cannot be corrected by the focus control. When this receiver is shut off, there is an afterglow, and I was wondering whether this will eventually cause an ion burn? W. O., Chicago, Ill.

The vertical flicker would most likely be caused by a defect in the vertical sweep section of the receiver. Check the

* Author: Mandl's Television Servicing

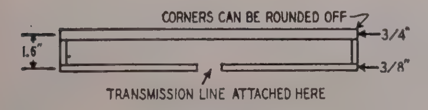


Fig. 1 (opposite page)—Basic four-element Yagi antenna discussed in the text.

Fig. 2 (above)—Special driven element raises Yagi impedance to 300-ohm value.

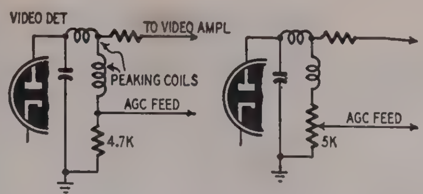


Fig. 3—The original circuit is on the left. Modified circuit is on the right.

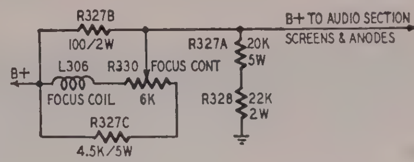


Fig. 4—The addition of R328 improves focus in Admiral 24F1 television sets.

6SN7-GT vertical oscillator as well as the 6S4 output amplifier. If the tubes are ok, check all resistors and capacitors in the R-C network feeding the oscillator, as well as all parts in the oscillator-amplifier circuits. If only the top of the picture jitters (for about 2 inches) dress the white lead from the horizontal hold control away from the vertical output transformer. Also check C417 (the 20-μf electrolytic capacitor in the vertical output circuit) for leakage.

Lack of focus in run 3 of chassis 24F1 is often caused by variations in characteristics of short-neck picture tubes. A 2-watt resistor (R328) was added in later production models as shown in Fig. 4 to improve focus. As the current from the focus coil also goes to the audio amplifier, a defective 6V6-GT audio-output tube sometimes causes this trouble.

The afterglow which you notice is not harmful provided the iron trap is adjusted properly. The afterglow is caused by the charge remaining on the high-voltage capacitors maintaining the electron stream while the cathode cools. This is no more harmful than any bright televised area during normal reception.

Lack of contrast

In an RCA 8T-241 receiver the contrast control must be turned fully clockwise before a fair picture is procured. When I turn up the brightness, retrace lines are visible. Brightness seems adequate but contrast does not. N. R., Brooklyn, N. Y.

The fact that you have to turn the contrast up fully to get a fair picture indicates lack of video signal strength at the grid of the picture tube. This could be caused by the following trouble (or troubles):

- Defective part or tube in tuner
- Defective part or tube in a.g.c. circuit
- Defective part or tube in video i.f. stages
- Defective part or tube in detector and video amplifier
- Improperly tracked tuner
- Misaligned i.f. stages
- Defective antenna system
- Defective contrast control
- Defective picture tube

Test all tubes from tuner to video amplifier feeding the picture tube. If these check all right, your only recourse is to check all the conditions listed above.

Fringe-area problems

I live in an ultra-fringe area 100 miles from Birmingham, 120 miles from Memphis, and 145 air miles from Nashville. Using an RCA 6T74 receiver with a booster, antenna rotator, and 5-element Yagi cut for channel 4, I get inconsistent reception. Sometimes all three stations come in perfect and at other times I get no signal at all.

All stations which I receive are on channel 4. The only station in my area which I do not receive is WAFM-TV in Birmingham, channel 13. I have tried a 5-element Yagi cut to channel 13, but even with a booster I have never received any reception in the two years I have had my receiver. The antenna is located on a 60-foot tower and our geographical location is high. Will you please tell me if there is anything I can do to receive channel 13 and improve channel 4 reception. R. R., Red Bay, Alabama.

Using a booster, a rotator, and a 5-element Yagi should give you more consistent reception than you are getting from channel 4, though the distances involved contribute pronounced effects from atmospheric conditions. Try an open-wire or slotted transmission line if you do not have one already. These have much lower losses than the solid-insulation types. You could also modify the receiver as detailed in the Television Service Clinic in the February, 1952, issue of RADIO-ELECTRONICS.

You should be able to get channel 13, as this station is nearer than the other two. Losses are greater for the higher frequencies, and extra precautions must be taken to minimize standing waves and attenuation. Use low-loss insulators and space the transmission line at least 6 inches away from the antenna mast and other metal objects. Wrap a 4 x 8-inch piece of tinfoil around the transmission line near the receiver antenna terminals. Slide this section up and down the line to tune for maximum pickup on channel 13. Also check the oscillator tracking in the receiver for this channel, as this may be the primary trouble.

Rectifier replacement

In a Westinghouse model H-619T12 receiver, two 6W4 low-voltage rectifiers are used. One of these rectifiers burns out repeatedly. I replaced both and the receiver worked fine for two months and then again the same one burned out. I replaced the tube and it lasted only a week. Upon checking the circuit with new tubes the receiver functions normally. All voltages and resistances are as indicated in the manufacturer's schematic. E. K., Buffalo, N. Y.

The two 6W4's in the low-voltage system function as a combined full-wave rectifier with equal distribution of the load. One tube shouldn't go bad repeatedly unless by coincidence the replacements were inferior. A defective socket could cause this condition. Corroded terminals or poor contacts might reduce the filament potential. Check the 6W4 socket connections.

The fact that only one tube is short-lived might also indicate that some intermittent overload occurs during operation. Check the filter capacitors to make sure their leakage hasn't increased, and check tubes and capacitors throughout the receiver. It would also be well to fuse the power supply to protect the rectifiers during momentary overload.

Repeated field-coil burnout

In a Motorola 17T1 receiver, the field coil of the speaker has burned out several times during the past year. What could be the reason for this? E. M., Gunter, Texas.

In this receiver it was found that some early-model transformers gave a B plus voltage 10 volts too high. For protection, a 150-ohm 15-watt resistor was inserted in the speaker field line (R104 in the new schematics). Check to see if this is in your receiver; if not, adding it may prevent speaker-field burnout.

Excessive buzz in Crosley

In a Crosley model 11-445M receiver, there is hum on all channels. Adjustment of the fine tuning lowers the hum, particularly if the fine tuning is turned away from the point of maximum reception. All tubes seem to check all right. What could cause this trouble? G. C., Long Island, N. Y.

This is an intercarrier-type receiver and the noise might be intercarrier buzz as well as power-supply hum.

Intercarrier buzz may be caused by incorrect alignment of the video i.f. stages. If the sound i.f. is not at the correct level on the response curve, severe intercarrier buzz will result. The settings of the fine tuning and contrast controls will change the degree of hum.

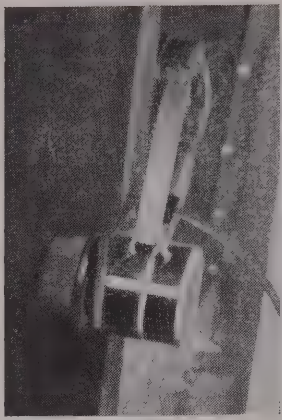
In some models electrolytic capacitor C120 did not have a good ground connection and this caused the hum and buzz symptoms. A wire should be soldered from the chassis to one of the grounding lugs on the capacitor if this has not been done at the factory. Also try adjusting the ratio-detector-transformer secondary by turning the screw slightly to left and then to right to find the setting which gives minimum hum. Make sure the back of the contrast control is shielded and that audio-coupling capacitors are dressed away from hum fields.

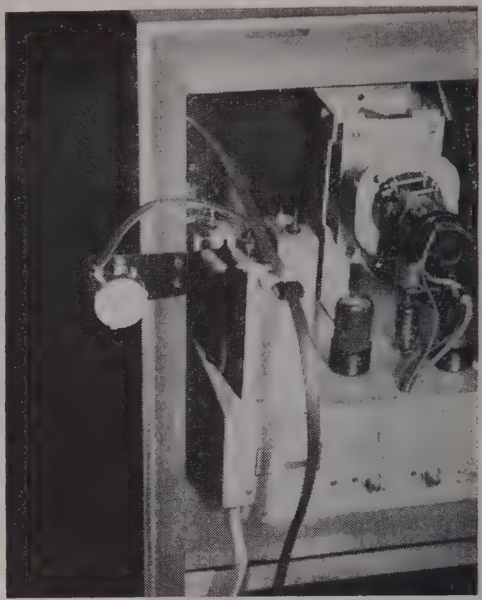
—end—

TRANSMISSION LINE TUNER

By ED NOLL and MATT MANDL

Fig. 1—Line tuner control circuit.





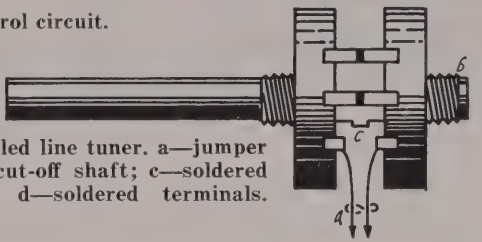


Fig. 2—Assembled line tuner. a—jumper to TV set; b—cut-off shaft; c—soldered switch levers; d—soldered terminals.

Above—left—Coupled units form TV line tuner. Above—Installation provides easy access to tuner from front of TV set.

TRANSMISSION line tuning is especially important—if ghosts are to be minimized and signal-to-noise ratio improved. Ever since our series of articles* on antennas and transmission lines, we have received numerous requests for information on practical methods of tuning the line.

Wrapping a 4-inch length of tin foil around the line and sliding it along the lead-in for best results has long been a favorite trick of TV technicians for improving television picture quality on the upper channels. Ribbon transmission lines can be improved by attaching matching stubs of proper length to the receiver antenna posts. But, while they appreciate the improved results, customers object to the awkward process of reaching behind the receiver to adjust the tin foil or connect stubs.

One simple but effective way of matching or tuning the lead-in is to use a dual potentiometer hooked up so that it acts as a variable section of a transmission line. Such a device is shown in the photographs and consists of a dual 6-ohm-per-section wire-wound potentiometer. The actual resistance value is not critical and may run up to 50 or 75 ohms, but each section must have the same resistance.

Two end terminals and the center terminals of the dual potentiometers are gang-soldered. The other two terminals are connected in parallel with the transmission line at the television receiver antenna posts. The connection from the dual control to the receiver should be made with a short length of ribbon line. Fig. 1 illustrates the actual circuit of the dual potentiometer.

The unit is mounted on a small piece of bakelite, wood, or hard rubber and fastened to the rear of the receiver with the shaft projecting along the side for convenience in adjusting. A small knob is placed on the end of the shaft.

With a station tuned in, the knob is turned until the best picture quality is obtained. In modern receivers having a.g.c. there will not be any appreciable change in contrast, except for very weak stations; however, over-all improvement in picture quality and a decided reduction in snow is usually noted.

Two separate wire-wound potentiometers can be used if it is difficult to obtain the low-resistance dual wire-wound potentiometer. These units must have a trip lever for an a.c. snap-on switch on the shaft. Fig. 2 illustrates the method of combining the two potentiometers in making the dual control. The shaft of one of the potentiometers is cut off almost flush with the threaded mounting sleeve. Use a file to remove any rough edges on the cut shaft.

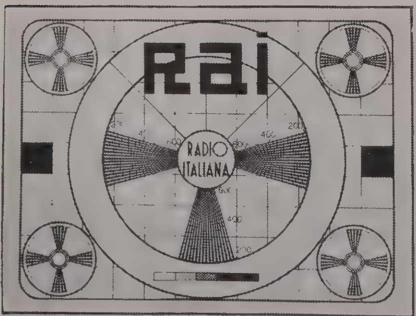
Align the trip levers and solder them together. Next solder the outside and center terminals together, leaving the opposing pair of outside terminals open for connection to the receiver. A short section of ribbon line is soldered to these end terminals.

The two potentiometers should be very close together so that the unit may function as a tunable stub. The resistance wire forms the series inductance and the proximity of the two elements creates the necessary capacitance.

A few years ago several manufacturers marketed small transmission-line tuners for TV sets. Set owners and technicians did not realize their advantages, and the devices were withdrawn from the market. The Standard Transformer Corporation had a device called "Telematch," and the Snyder Manufacturing Co. produced a unit similar to the one described. Some purchasers were enthusiastic about the results and are still using them on their receivers. Similar improvements can be achieved by constructing the dual-control affair discussed in this article, unless, by remote coincidence, you have the perfect transmission line, and have it exactly matched to both the antenna and the receiver input impedance!

—end—

*RADIO-ELECTRONICS, *Jan.-June, 1949.*



600-line pattern sent by Italian stations.

TELEVISION IN ITALY

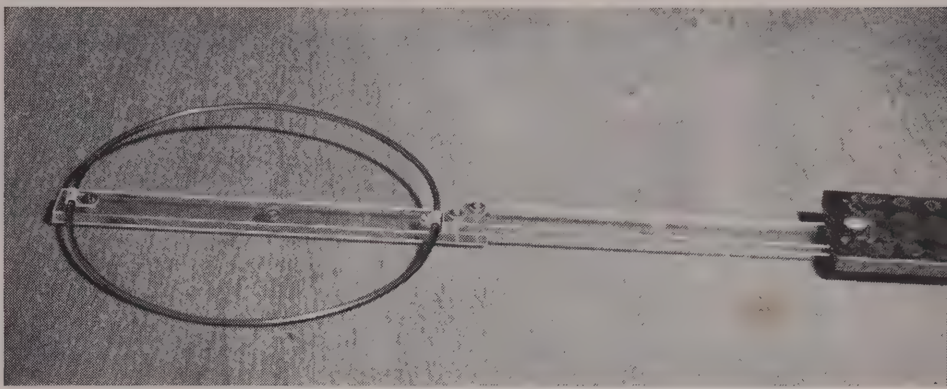
TV in Italy has made rapid technical strides despite shortages of test equipment and receivers. The Italian Radio (RAI) has been training technicians and cameramen for the past two years in an experimental station in Turin. Now Milan is on the air with a 5-kw General Electric transmitter and 6-bay "superturnstile" antenna giving 35 kw effective radiated power. Video is 175.25 mc, sound 180.75. Turin and Milan are connected by a radio link until a coaxial line is completed.

Italian stations transmit the new European standard 625-line picture, with a video bandwidth of 5 mc.

The Italian government plans TV coverage for 13,000,000 people in the northern part of the country by 1953.

—end—

Get peak performance from small sets by using



the TUNING WAND as a SERVICE TOOL

By GERALD J. MACHEAK

MOST small a.c.-d.c. sets have inadequate gain at the low-frequency end of the dial due to imperfect tracking between r.f. and oscillator sections. Manufacturers usually peak the oscillator at 1600 to 1700 kc, then adjust the r.f. trimmer for maximum output at 1400 kc, and let the low end take care of itself.

Practically all modern tuning capacitors have split end plates for adjusting the oscillator-r.f. tracking at several points on the dial. With the aid of the simple service tools described here, any set with split-plate tuning and a built-in loop antenna can be aligned for almost perfect tracking, with improved sensitivity and selectivity, especially at the low end.

One of the tools is a shielded loop for coupling the signal generator to the receiver by radiation. The other tool is a special tuning wand that shows which way to bend the capacitor plates for maximum output at any frequency.

The loop (Fig. 1) is made of ½-inch copper tubing bent into a circle 7 inches in diameter. Cut or file a ½-inch hole in the *outside wall* directly opposite the open ends (Fig. 1-a). Attach a 1-inch length of phenolic or polystyrene tubing to one of the open ends. Thread two full turns of good-quality insulated hookup wire through the tubing and bring the wire ends out through the ½-inch hole. (Fig. 1-b). Slip the free end of the copper tubing into the open end of the insulating sleeve and fasten securely, leaving a ½-inch gap between the ends of the copper tube. Put a ground strap around the tubing near the ½-inch hole for the two lead wires of the loop winding.

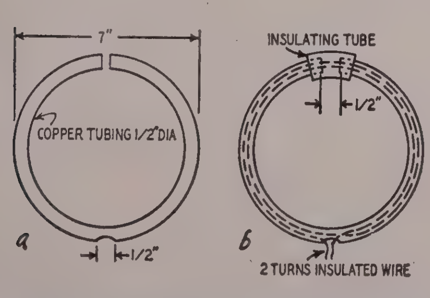


Fig. 1—(a) Shield for signal-generator loop. (b) Details of loop winding and radiating gap. Shield must be grounded.

The tuning wand is a 16-inch length of ¾-inch plastic or phenolic rod or tubing. A closed loop of No. 14 bare copper wire, 6 inches in diameter, is fastened to one end. At the opposite end is a 3 x 4-inch bakelite plate, drilled to hold as many powdered-iron slugs as you can lay your hands on. The slugs can be threaded or cemented in place.

Clip the ends of the hookup wire to the signal-generator cable and ground the copper loop shield. Place the receiver about two feet from the loop. After a 10-minute warmup set the generator and receiver at the high frequency recommended by the set manufacturer and adjust the oscillator trimmer for maximum output. Retune the generator and set to 1400 kc and peak the r.f. trimmer. Then change the generator to a lower frequency (say 1200 kc) and tune the receiver to the same point. Insert the wire-loop end of the tuning wand in the path of the signal between generator and receiver. If the output increases, bend the partially meshed split plate on the r.f. tuning capacitor *out* to reduce the capacitance. If the output drops when the loop is inserted, reverse the tuning wand and note the effect of the powdered-iron end. If this raises the output it means capacitance must be added. This is done by bending the split plate *in*. Follow the same procedure at as many points as you wish. When the r.f. tuning capacitor is correctly adjusted either end of the tuning wand will reduce the output.

Even better tracking can be obtained by repeating the procedure with the split plates of the oscillator section. This requires extreme care to prevent throwing off the high end, and should be done only *after the r.f. section has been tracked.*

—end—

SIMPLER FORMULAS

Most of us know and use the standard formula for X_c (capacitive reactance). It is $\frac{1}{2\pi\,(\text{cycles})\ (\text{farads})}$

We find this difficult for two reasons. A farad is not a practical unit, so we must always convert. Also, the factor 2π tends to muss up the rest of the equation. For these reasons I use an equivalent formula, simpler than the above, yet with almost the same accuracy. It is

$$160{,}000/(\text{cycles})\ (\mu f)$$

The above is suitable for low frequencies when we deal with large capacitors. For high frequencies the following is more appropriate:

$$160{,}000/(\text{mc})\ (\mu\mu f)$$

Just the other day I came across this problem: "Find the reactance of .01 μf at 800 cycles." Using the first formula, I came up with the answer by mere inspection. It takes much longer the conventional way. Now try this one: 250 μμf at 3 mc. Again we have the answer almost immediately: 213 ohms.

In a similar way we can use an easier equation for frequency. It is

$$(\text{mc}) = \frac{160}{\sqrt{(\mu\mu f)\ (\mu h)}}$$

For example, find the resonant frequency of 300 μh tuned by 340 μμf. The answer is 500 kc. Although we still need the square root, we have converted to practical units. Also, we have eliminated the awkward factor, 2π.—*I. Queen*

—end—

Another look at the unusual in modern receiver circuits

short circuits

By ROBERT F. SCOTT
Technical Editor

IN MANY of the simpler TV sets the 60-cycle vertical sync pulses are used to develop a.g.c. voltage. This system requires a relatively long time-constant so the a.g.c. cannot follow rapid changes in signal strength like those caused by aircraft flutter. To overcome this disadvantage, several types of keyed, pulsed, or gated a.g.c. have been developed. The best-known form of keyed a.g.c. uses a pentode whose plate current is controlled solely by the peak level (sync pulses) of the composite video signal applied to its control grid. The plate current develops the negative voltage used for a.g.c. Variations of this circuit are used by several manufacturers.

The G-E circuit

The keyed-a.g.c. circuit used in the G-E 17C110 chassis is one variation of the basic system. The circuit is shown in Fig. 1. The grid and cathode of the 6AU6 keyer tube are connected across 3,000 ohms of the video-amplifier plate load. The voltage drop across this resistor biases the keyer tube to cutoff. The keyer-tube plate is connected to ground through a winding on the width coil and a 322,000-ohm resistor chain. Plate current does not flow until the positive sync pulses across the 3,000-ohm grid resistor coincide with the positive-going keying pulses injected into the plate circuit by the width-coil winding. The 6AU6 plate current which flows through the 322,000-ohm resistance is independent of plate voltage and entirely dependent on the peak amplitude of the signal appearing in the grid circuit. The a.g.c. voltage is tapped off at the junction of the 150,000-ohm plate resistors.

Some a.g.c. bias must be provided to protect the r.f. and i.f. tubes when no signal is received and the a.g.c. tube cannot conduct. This is obtained from the horizontal oscillator, which develops a large, stable, negative bias at its grid. The 470,000-ohm and 22,000-ohm resistors form a voltage divider across the horizontal oscillator grid circuit. About 0.6 volt for the a.g.c. line is taken from the 22,000-ohm tap.

The video amplifier is operated as a noise limiter. Its operating voltages are set so the tips of the negative sync pulses from the detector drive the video amplifier almost to cutoff. Noise pulses stronger than the sync tips are clipped slightly above the level of the sync tips.

The screen grid of the keyer tube is supplied from the low-voltage side of a 2,350-ohm dropping resistor for the plates and screens of the first and second video i.f. amplifiers connected to the a.g.c. line. When the incoming signal is weak, the i.f. plate currents are high and the dropping resistor decreases the voltage on the screen of the keyer tube. The reduced screen voltage lowers the gain of the keyer and decreases the a.g.c. voltage. This increases the gain of the second r.f. amplifier and the first and second video i.f. stages to compensate for the weak signal.

Du Mont keyed a.g.c.

The Du Mont keyed-a.g.c. system used in the RA-160 and RA-162 chassis consists of a 12AX7 dual triode and one-half of a 6AL5. See Fig. 2. The first section of the 12AX7 is the a.g.c. amplifier and the second section is the a.g.c. keyer tube or "gate." A portion of the composite video signal is taken off the plate of the 6AG7 video amplifier and fed to the grid of the a.g.c. amplifier. Direct coupling is used between the a.g.c. amplifier and the sync take-off point. The voltage across the 47,000-ohm resistor biases the a.g.c. amplifier grid. Additional bias which reduces the plate current nearly to cutoff is developed across the 820,000-ohm cathode resistor. The operating bias is set so the tube passes only the portion of the grid signal above the level of the blanking pedestal. Consequently only the sync pulses appear in the cathode circuit. The video information is eliminated so the a.g.c. bias is determined solely by the level of the sync tips.

Variations in the level of the r.f. signal applied to the receiver cause corresponding variations in the amplitude of the signal applied to the grid of the a.g.c. amplifier. Since the composite video applied to the grid of the a.g.c. amplifier is positive, an increase in its amplitude causes a greater voltage across the 820,000-ohm cathode resistor. A decrease in the amplitude of the grid signal results in a corresponding reduction in the cathode voltage.

This varying cathode voltage is applied to the grid of the a.g.c. gate tube through a low-pass filter consisting of 10,000-ohm and 1.2-megohm resistors and .02- and .03-μf capacitors. The filter removes the sync pulses and passes only the d.c. voltage which varies in amplitude with the strength of the incoming TV station carrier.

A portion of the boosted B plus voltage is applied to the cathode of the a.g.c. gate through a voltage divider consisting of the 100,000- and 68,000-ohm resistors. The positive voltage on the cathode of the gate tube is considerably greater than the positive voltage on the grid so the tube remains cut off until a sufficiently large positive voltage is applied to the grid or a negative voltage to the cathode.

A sawtooth from the output of the horizontal oscillator is applied to the cathode of the gate tube through a differentiating network consisting of the 120-μμf capacitor, the 10,000-ohm AGC ADJUST control and the .01-μf capacitor. This network modifies the sawtooth so the signal on the cathode of the gate tube is a small sawtooth with high-amplitude negative peaks as shown on Fig. 2. The amplitude of the signal applied to the cathode is controlled by the setting of the AGC ADJUST control. It is sufficient to make the gate tube conduct.

Since the amplitude of the cathode signal which causes conduction is constant, the signal at the plate of the gate tube is a negative-going sawtooth whose amplitude depends directly on the strength of the incoming r.f. signal.

The output of the a.g.c. gate is capacitance-coupled to the cathode of the a.g.c. rectifier. Negative voltage from the rectifier plate is applied to the grids of the first and second video i.f. amplifiers through filter networks. The available a.g.c. voltage is applied to a voltage-divider network consisting of two 100,000-ohm resistors in series between the rectifier plate and ground. The junction of these resistors is connected to a tap on the HIGH-LOW a.g.c. switch. When the switch is in the HIGH position, a portion of the a.g.c. voltage is applied to the first r.f. amplifier to prevent the tuner from overloading on strong signals. A small fixed positive bias (delay) is applied to the cathode of the a.g.c. rectifier to prevent a.g.c. voltage from being applied to the controlled stages on weak signals.

When the switch is in the LOW position, the r.f.-amplifier grid return is grounded through the 5.6-ohm resistor. The ungrounded end of this resistor is connected to ground on the sweep chassis through the cable between the sweep and signal chassis. The negative returns of the tubes on the signal chassis are grounded through this resistor. The voltage across it biases the r.f. amplifier when there is no a.g.c.

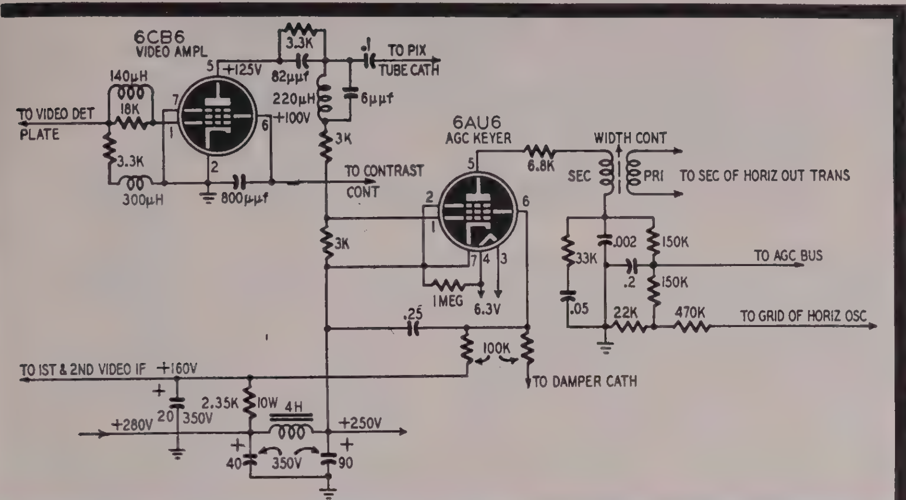


Fig. 1—The keyed a.g.c. circuit in G-E's 17C110 is similar to the basic system.

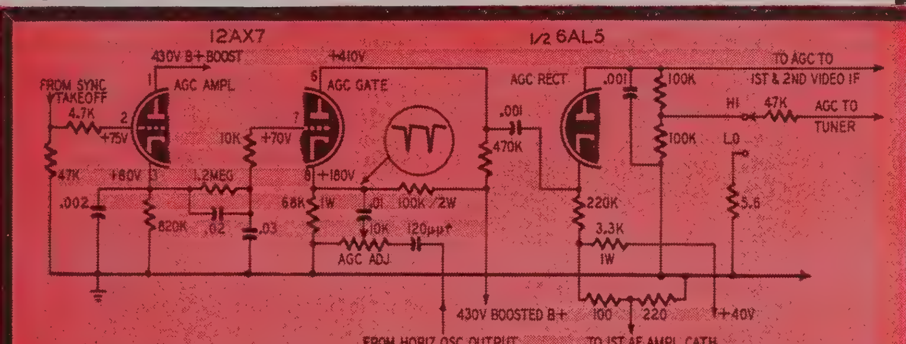


Fig. 2—The a.g.c. in DuMont's RA-16 is a combination of keyed and rectifier types.

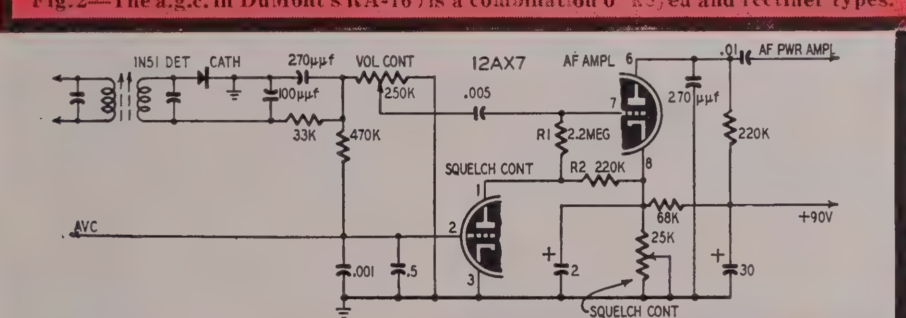


Fig. 3—Audio squelch circuit. A.v.c. cuts off squelch tube so amplifier conducts.

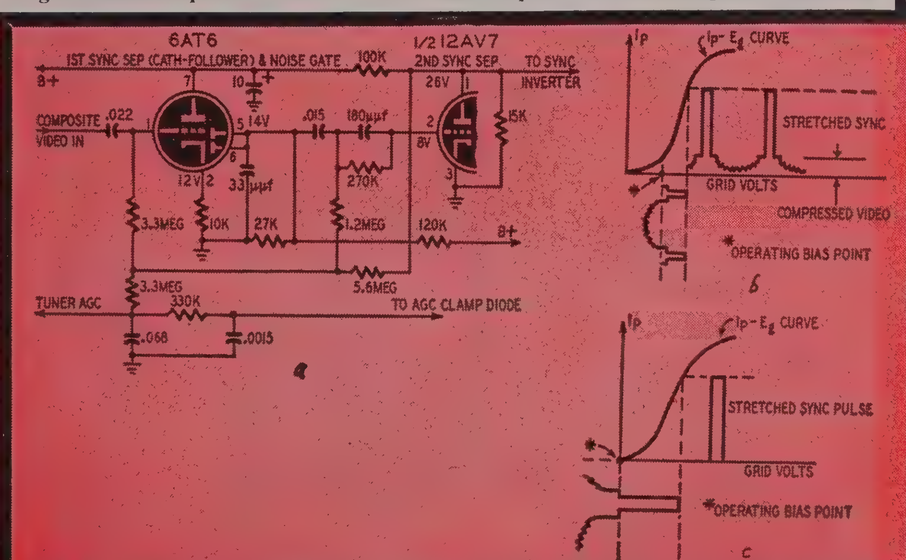


Fig. 4-a—Diagram of the Philco noise-immune sync circuit. The noise-gate diode limits noise to the level of the sync tips. Fig. 4-b—Operating curve of first sync separator. Bias point causes compression of video and stretching of sync. Fig. 4-c—Operating conditions of the 12AV7 second-sync separator circuit.

Monitoradio audio squelch

Receivers used by police, taxi operators, emergency services, etc., are often operated for considerable periods of time between received signals. When no signal is coming in, the receiver operates at full sensitivity and the resulting noise is distracting and annoying to the operators. Various squelch systems have been developed to silence the receiver until a signal is received. One of the simplest is used in the model AR-1 Monitoradio. The circuit is shown in Fig. 3.

In the absence of a signal, there is no d.c. voltage on the a.v.c. line. The squelch tube conducts heavily. The voltage drop across the 220,000-ohm squelch-tube load resistor R2 makes the plate end of the resistor negative with respect to the end connected to the cathode of the a.f. amplifier. Since the grid of the a.f. amplifier is returned to the plate of the squelch tube through R1, it is biased negatively by the voltage drop across R2. The voltage across R2 biases the a.f. amplifier to cutoff so the characteristic hiss and background noise cannot pass through to the speaker.

When a signal comes in, a negative bias voltage appears on the a.v.c. line and cuts off the squelch-control tube so there is no d.c. drop across R2. The a.f. amplifier now operates normally. The audio signal applied to its grid is amplified and passed on to the grid of the power-amplifier stage.

The sensitivity of the squelch tube is determined by the setting of the 25,000-ohm SQUELCH CONTROL. This resistor is connected as a bleeder on the B plus line supplying the plate of the squelch-control tube. The SQUELCH CONTROL is normally set to the point where the squelch-control tube plate voltage is low enough to cause the plate current to be cut off by the a.v.c. voltage developed by a signal just above the noise level.

Noise-immune sync circuit

TV receiver manufacturers are constantly seeking simpler and more efficient sync circuits which are relatively free from false triggering by noise pulses. One such circuit is used in late Philco receivers. One version of the noise-immune circuit is shown in Fig. 4. The circuit consists of a 6AT6 cathode-follower-type first sync separator, a diode noise gate, and one-half of a 12AV7 as the second sync separator. The fact that the first sync separator is a cathode follower may be difficult to follow without a breakdown of the circuit. If you have difficulty in understanding the circuit, redraw the 6AT6 as two separate tubes, with the triode section (pins 1, 2, and 7) in one envelope and the diode (pins 2, 5, and 6) in the other.

Now, add the 10,000-ohm cathode resistor and B-plus to the plate of the triode section. Add an output lead from the cathode (pin 2) of the triode. Looks like a cathode follower doesn't it? Well, it is.

Since pin 2, the cathode connection, is common to the diode and triode, extend the output lead to the cathode of the diode. Sketch in the diode plate-circuit components and then compare your circuit line-for-line with the diagram in Fig. 4. By now, you should see that the 6AT6 is connected as a cathode follower directly coupled to the cathode of a diode. Now, let's see how it works.

Composite video is tapped off the plate of the first video amplifier and is fed to the grid of the 6AT6 sync separator through a .022-μf capacitor. This section of the 6AT6 is a cathode follower operated so the positive-going sync pulses fall on the linear portion of the I_p–E_g curve where they receive maximum amplification. The video information is handled on the nonlinear portion of the curve so it is compressed. The operation of this circuit is shown at *b* in Fig. 4. The stretched sync pulses and compressed video appear across the 10,000-ohm cathode load resistor. Since the cathode is common to the triode and diode sections of the tube, this signal is directly coupled into the diode section which is operated as a *noise gate*. This circuit limits noise pulses so their amplitude cannot exceed the amplitude of the sync pulses.

The noise-gate diode is operated with its plate only a few volts more positive than its cathode. Positive signals equal to or less than the amplitude of the sync pulses cause the diode to conduct so the output appears at the diode plates (pins 5 and 6). Signals (noise pulses) of greater amplitude than the sync pulses make the cathode more positive than the plates so the diode cuts off. The signal at the diode plates consists of stretched sync pulses, compressed video information, and limited noise pulses.

This signal is fed to the grid of the second sync separator through a .015-μf capacitor and a 180-μμf capacitor shunted by a 270,000-ohm resistor. The 270,000-ohm resistor passes the low-frequency vertical sync pulses around the capacitor. The capacitor handles the higher-frequency horizontal sync signal.

The second sync separator (one-half 12AV7) completely separates the stretched sync pulses from the compressed video signal and blanking information. It operates with low plate voltage so a positive pulse equal to or greater than the amplitude of the blanking pedestal is required to make it conduct. The operation of the second sync separator is shown in *c* in Fig. 4.

The negative-going sync pulses which appear in the plate circuit of the second sync separator are fed to a sync inverter tube which develops the positive pulses required to trigger the sweep oscillators.

Some Philco sets use a modification of this circuit. One-half of a 12AV7 is the cathode-follower first sync separator. One triode section of a 12AU7 has its plate and grid strapped together to operate as the noise gate. The remaining section is the sync separator.

—end—

A FEW SIMPLE CURES FOR SUPERHET SQUEALS

By CHARLES ERWIN COHN

Continuous squeals (canaries) in superhet receivers are common, especially in small receivers, and the technician has developed his own methods of handling them. There is one type of squeal which may be found in high-gain receivers, and which may be very difficult to locate or cure. It is especially prevalent in home-constructed jobs. After building a sensitive superhet receiver, the constructor often finds strong oscillations which seem to defy every effort to clean them up. The most common cause of these oscillations is feedback from the second detector to the converter.

Feedback may take place through the wiring, by capacitive coupling between tube elements, or by radiation from the detector circuit picked up by the antenna.

Determine if radiation is actually the cause, by pulling out the converter tube. If the oscillation stops, this is the answer. However, if it continues, then the i.f. amplifiers are at fault. In receivers with a.v.c., the oscillation shows up as a periodic thumping.

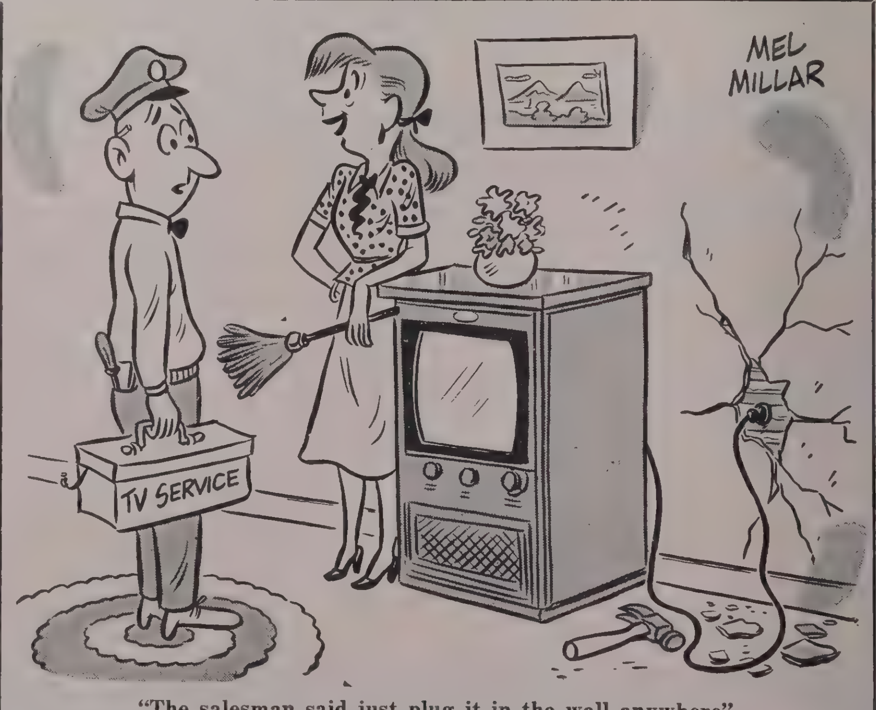
Wiring pickup is the hardest to handle, and should be guarded against in the design. Lay out the set so that the converter and second-detector circuits are as widely separated as possible. In completed receivers the only remedy is to shorten all signal leads in the second-detector circuit. Bypass all other leads right at the socket- or i.f.-transformer terminals. Use shielding in extreme cases.

Use metal tubes if possible, or install close-fitting, well-grounded shields over glass types.

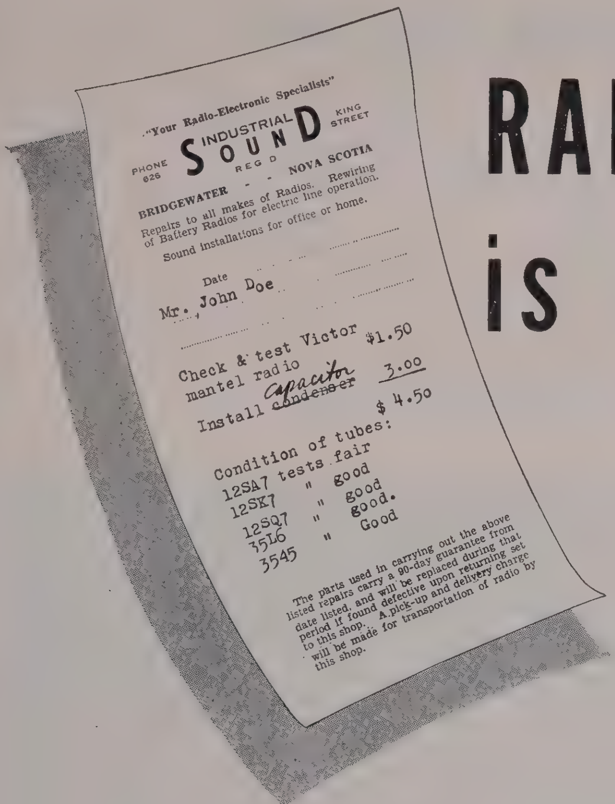
If oscillation occurs only when the set is tuned to a signal near the intermediate frequency, the feedback is probably through the antenna or r.f. circuits. Check this by disconnecting the antenna. This trouble is especially noticeable at the low-frequency end of the dial in broadcast receivers using 455 kc i.f. In these cases, try a lower i.f., and check for i.f. radiation from external leads such as the line cord, power-supply cable, and speaker or headphone cords.

In converters using a separate oscillator with oscillator voltage taken from plate or cathode, the lead to the converter is a common source of pickup. Moving the takeoff to the oscillator grid may help, because of the low impedance of the oscillator tank to i.f. signals.

Anyone planning to build a high-gain receiver should note these ideas. A careful layout with plenty of separation between front and rear ends, complete shielding (including the tubes), and complete bypassing and decoupling of *all* r.f. and i.f. circuits will go a long way toward eliminating oscillation troubles. —end—



"The salesman said just plug it in the wall anywhere"



RADIO SERVICING is a BUSINESS

Make your rates and stick to them—forestall callbacks and customers' gripes with adequate records

By J. W. ESSEX

"MANY are called but few are chosen," goes the old scriptural saying. It applies definitely to the success of a radio service business. We have all seen service shops enjoying what looked like an easy living; but when the sheriff arrived to lock up their doors you realized that someone slipped somewhere.

The average technician is not to blame for failing to recognize the importance of sound business methods, because many radio schools fail in this one important point. The technical training in my first correspondence course was more than adequate, but the business end was sadly neglected. I remember writing to them after graduating to ask for information on making out bills for service under the "rate system." When I finally received the information, it was like sunshine breaking through after a rainy day. I found their little rate charge book as valuable as the whole technical course. *But I did not get it until I wrote and asked for it.*

That is just one example of how lightly the most important phase of radio servicing is skimmed over. The worst of it is, lack of training in business methods usually leads to timidity in asking enough for your efforts. At the opposite extreme is the error of charging too much in an effort to break even. This will make you lose out to competitors who have somehow managed to strike a happy medium.

The Philco people have compiled a Standard Radio Manufacturer's service rate as a basis for charges. A system set up by the National Radio Institute Alumni Association in Washington is patterned along the same line. The two systems are basically similar. NRI differs in charging an initial fee to cover the work involved in checking tubes, inspecting chassis, removal and installation in cabinet (and talking to the customer, which is always extra time). *It is important to your monthly balance sheet that you get paid for these extras.* This is what makes the difference between a good income and just a fair one.

(*Editor's note*: Service technicians are advised to write directly to these organizations for copies of current rate schedules, since these may vary with location and season.)

Don't jump to conclusions about your own method of running your business. I agree that what constitutes a proper return for effort spent in diagnosing and remedying faults in radio circuits is always open to debate. For example, I have modified the listed charges for installing capacitors when more than one is replaced. My charge for the first capacitor is $3.00; for the second $1.50, and 50 cents each for any others required. The final charges are still reasonable for this part of Canada (they would probably be higher in "The States"), but I have maintained the rate system for figuring bills.

It is important to record each step of your work and the charge for it; you will find your initiative automatically sustained because there is compensation for your extra effort. Gone will be those annoying "call-backs" where you were satisfied with a quick repair (and a seemingly quick dollar). Your job will bring far more satisfaction to you and your customer when it doesn't bounce back the next day.

Keeping a record of all work done on each set will pay off in another way. As time goes on and some of your early repairs return for checkups, you can easily refer back to what was done earlier in the matter of replacements. The record also provides a source of names for a mailing list. If you guarantee the parts you put in a set it is imperative you have a complete record in case the set is returned under the guarantee. It pays to have proof that the tube that popped was not one that you put in, but one of the older ones, so you can sell the customer a new tube and still keep his good-will. To this end, it is wise to list the condition of all tubes on your bill. You will get that tube sale sooner or later.

I have been using the NRI rate system for over two years (with only minor modifications) and find it more than satisfactory. It is true that rate charges will have to stand the test of competition. Each locality will have its own peculiarities, and your competitor down the street will have some influence on your final rate card. But once your rates are set, *stick to them,* and soon you will be as much at home in making out bills as you are in getting the radio repaired.

Concentrate on doing good work, and the rate card will take care of the financial end for you. Good work will encourage more business, and with a proper set of rates, you can always come out in the black at the end of the month. —end—

ELECTRONICS and MUSIC

PART XXVII

Obstacles and opportunities in building an organ yourself—last installment in this series.

By RICHARD H. DORF

DURING the two years and more that this series of articles has been running in RADIO-ELECTRONICS the writer has received a good deal of mail from readers who have problems of one sort or another in designing and building electronic musical instruments. The general trend of the inquiries indicates that certain problems are widespread. This article—the final one of the present series—will attempt to give some general conclusions the writer has reached on constructing electronic musical instruments.

It is not surprising that among the many devices made possible by electronics, musical instruments rate high as construction projects. The possible reward is very attractive—a means of musical expression far more versatile than any standard instrument except the pipe organ—and there seems to be a highly intriguing quality about the idea of making music from resistors, capacitors, and tubes. The reward, however, in common with most other rewards in this world, must be earned. And the earning process is long, painstaking, and expensive. In an electronic organ—the most popular project—the basic fact that confronts one is that—at the very least—61 separate tones must be generated, and they must be available in any combination. No matter how hard we may try to circumvent it, 61 or more individual tone generators must be built. True, there have been a few patents on ways of making fewer generators do the job, but they are not particularly practical. Witness the fact that no commercial instruments (except the simplified Hammond Chord Organ) have taken this path to economy. Sixty-one of anything involving vacuum tubes is a lot, especially when this only starts the job—there is still the problem of what to do with the tones once you have them!

The keying system is one of the worst headaches, and not just because of the minimum of 61 switches per manual. Audio circuits have the perverse quality of clicking and popping when keyed, and of sounding like code-practice oscillators when keying is practically instantaneous.

All in all, building an organ is not a task to be considered lightly. No matter what the design, it entails many hours (hundreds of hours is more like it) of hard labor, much head-scratching in design, unavoidable hours of experiment, and enough dollars to cover the cost of an enormous list of parts.

The writer has given this warning to all the many correspondents who have written "Please send me a complete set of instructions for building an electronic organ." No "complete set of instructions" is available, either from this source or any other source known, though a complete organ has been designed and is now under construction. To answer the obvious question, this design will be published in full some time after the end of the summer and complete sets of construction prints will be offered to those who want them. There are too many problems involved in a genuinely musical instrument to allow anyone with a clear conscience to offer a design that has not been proved.

Deciding on requirements

This series started 27 months ago with a statement to the effect that simply assembling some oscillators which have the requisite frequencies does not yield a musical instrument. Keeping that in mind, let us try to decide what the end results and means should be for an individual who wants to construct an electronic organ.

The first requirement is a set of tone

generators. It is desirable to have at least 5 octaves (plus the top C) of keys, establishing 61 notes as a minimum. It is best to have an extra octave—a *16-foot* register—at the bottom to give a good bass foundation, whether or not a pedal clavier is included. It is possible to get by without an extra octave on top (as in the Baldwin model 5) and to include a *4-foot* register by having the last octave of keys repeat the notes of the fourth octave in the high register. But if it adds no excessive complication, the extra octave is useful. With a total of seven octaves and top C we have 85 notes to generate; without the top octave, 73.

It is not easy to use 73 individual, unsynchronized oscillators, as in the Connsonata, because of tuning difficulties and drift. Usually the logical decision is octave strings, with 12 sets of frequency dividers or multipliers, each set generating as many notes as there are octaves of generators in the organ—from 5 to 7. More than seven (used to provide *2-foot* ranges and higher) rarely contribute enough to the musical results to justify the effort.

Each divider string must begin with a sure-fire self-excited oscillator stable within ¼ of 1% accuracy or better. Design should begin with laboratory-bench experiments with various oscillator types. A reference source for tone pitch is a necessity, since no variable-frequency audio test generator is accurate enough. A newly-tuned piano is good; a Hammond organ is even better. A Strobocon is best but not generally available. A good-quality harmonica can be used if it is first checked with a well-tuned piano. This reference source will provide the essential accuracy for final tune-up. For the design procedure it need only be stable, not necessarily exactly on pitch.

After a sample oscillator is built (breadboard style is recommended) it should be tuned to coincide with a note from the reference source. Tune very carefully, either by ear—counting beats until the new oscillator is right on the nose—or with an oscilloscope Lissajous pattern. Let the oscillator run for several hours, then check its frequency again. Turn it off and let it cool, then turn it on; after five minutes or so check it again. In each case the pitch should be so close to the reference that the note is musically acceptable. The figure of ¼ of 1% accuracy is the *outside limit,* and it means 1 cycle permissible error at 400 cycles or 10 cycles at 4,000 cycles, which is not much! If the first design does not measure up, discard it and try again. Never skip this tryout procedure! You may copy someone else's design electron for electron and still have unstable oscillators.

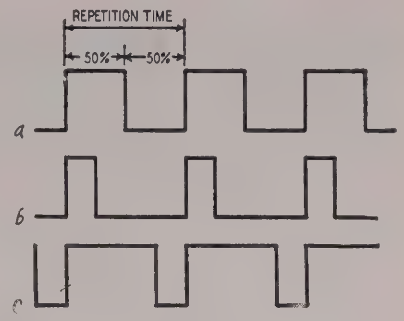
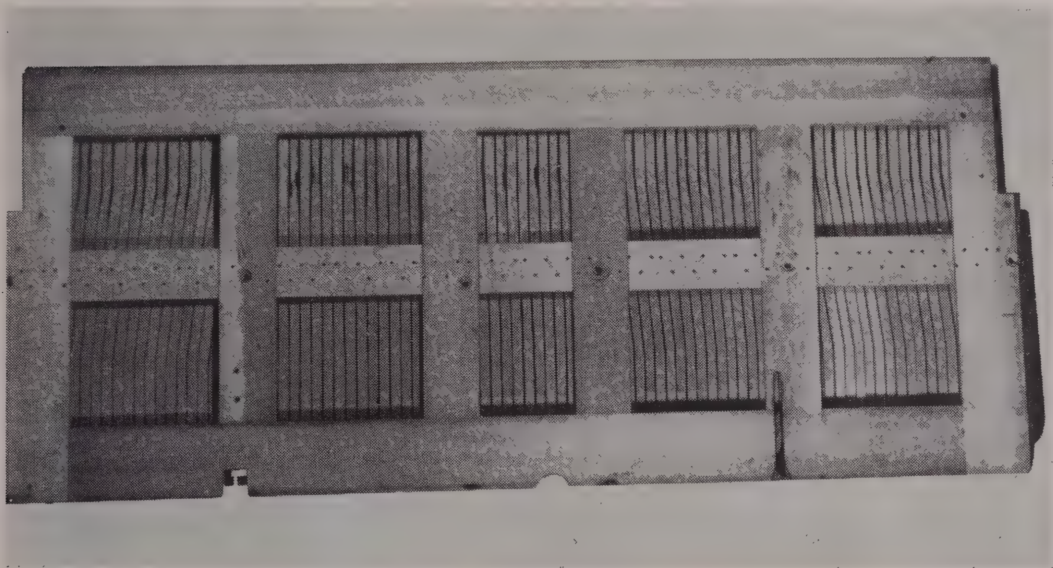


Fig. 1—(a) Symmetrical square wave—characteristic of woodwind tone. (b and c) Preferred waveforms for deriving a wide variety of instrument tone colors.



Top and bottom views of a high-quality piano keyboard easily adapted to electronic-organ use. The felt hammers are removed and the actuating arms cut down to just the length needed for the key switches.

Before deciding on the system of dividing or multiplying frequencies, the other organ requirements must be outlined. First, what method of tone coloring will be used? If harmonic synthesis (Hammond-Organ style) is wanted, then each generated tone must have sinusoidal waveform, which is not easy with oscillators that must be synchronized. Perhaps the most practical way to obtain sine waves with synchronized oscillator strings is to generate some other kind of waveform and then use a low-pass filter in the keying system between each octave group of tones and the rest of the system. This, incidentally, will kill key clicks as well.

You may decide to use a phonic-wheel system, as in the Hammond, but here again bench experiments must be made with sample tone wheels and pickup magnets to determine the best metal and the precision with which each wheel must be made. This method is suitable only for people with marked mechanical-design ability and the necessary tools and facilities.

If the *formant* method (used in the Baldwin and Minshall organs and, in simpler form, in the Solovox and Organo) is chosen, the tones must have a complex waveshape, the more complex the better. Sawtooth waves are best because they contain a smooth progression of even harmonics, but square waves are useful too. The pulse width should be greater or less than 50 percent of the repetition rate to avoid giving all tones a stopped or woodwind quality. (See Fig.1.) Square-wave tones can be obtained from multivibrators and flip-flop circuits, while sawtooth signals usually entail relaxation oscillations of one kind or another.

You may prefer a formant and mixer system like the one in the Connsonata. The Connsonata uses individual oscillators which yield both sine and pulse signals. This can be done with synchronized strings by using octave filters as suggested above to obtain sine waves after keying, and by using separate key switches followed by differentiators (high-pass filters, effectively) to obtain sharp pulses. Don't use frequency dividers or multipliers which will work only at a single frequency. Any system, even though it is for only one note of the 12, should function well over a range of at least three semitones. Otherwise it may as well be discarded.

The keying system is an important decision. In a pipe organ each stop is normally available in a certain register —*4-*, *8-*, *16-foot*, etc.—and couplers are

provided to give the same stops in other registers as well. The Baldwin organ is an electronic example of this practice. It is also feasible to key all tones at one or more registers and have stop filters passing tones of any register selected, as in the Minshall.

Key click is the most serious problem in any keying design. The problem has never really been solved in an ideal way, but probably the best method (though not the easiest or cheapest) is Baldwin's variable-resistance key switches. Unfortunately, these switches are not easy to make and can be obtained only from Baldwin, though they may be available as replacements from some Baldwin dealers. Assuming there is no d.c. being keyed, the clicks take place in a high-frequency region somewhat above the frequency of the highest fundamental. They may be eliminated by octave filters, as in the Minshall, though this also does away with some of the harmonic content of the signal waveform. Vacuum-tube keying is practical from the schematic viewpoint but means the addition of at least one tube for each section of each key switch assembly. Vacuum-tube keying requires at least a 2-section R-C delay network at the grid. The rise time must be rather slow to avoid the thump caused by plate-current rush unless well-balanced push-pull tubes are used.

Tone-coloring methods have been described in this series and the one chosen is a matter of preference. The designer should listen to good pipe organs and recordings and judge results by ear.

Amplifiers should have exceptional power-handling capacity in the low-frequency region. This means good output transformers and plenty of negative feedback. Twenty watts is about the minimum power output for any organ, even in small rooms. Speaker systems should have good bass characteristics; it is usually best to use one to four heavy speakers with at least 12-inch cones. Tweeters are rarely necessary, though they may add something to a good instrument. Intermodulation distortion must be kept low, for sustained multiple tones produce very annoying beat tones in a nonlinear system. Frequency non-linearity, of course, will change the tone colors of any kind of organ, since it has the effect of a formant filter.

Materials and construction

Every organ includes a number of purely mechanical complications, the most obvious of which are the keyboards or manuals. The simplest solution is to get a second-hand pipe-organ console and build everything inside it. The keys, action, pedals, housing, stop tabs, and so on, are already provided. Consoles are not particularly hard to find, especially in the larger cities. Look up organ repairmen in the telephone book and ask them to notify you when they get a console. Most of them will have one sooner or later. Another source is a local dealer in electronic organs; he often will sell or give away the pipe or reed organ he replaces.

The console should be examined carefully to see that the action is in working order or easily repairable. Damaged key ivories are easily replaced either with new ones or those peeled from another used keyboard. The pedal action should also be examined. If possible, obtain a console with at least as many stop tablets or knobs as your design calls for. Extra ones are not easy to add, especially if good appearance is a factor. A combination action is a desirable feature; the pneumatic actuators usually can be removed and solenoid actuators substituted. Reed-organ consoles are acceptable, but usually require more work for adaptation. The keys are usually much longer than necessary, since they had mechanical work to do rather than simple electrical contacting, and the case may be deeper than required. The case can be cut down, of course.

A console can be built by a handy woodworker, the only outside requirement being the keyboard. Here again an organ repairman may be able to supply a keyboard from an old organ or harmonium. Be careful to get a C-to-C keyboard, since some harmoniums have F-to-F manuals. The photographs show top and bottom views of a Steinway piano keyboard purchased for very little from a piano-repair concern. The keys are in perfect condition, and were cut, after the photo was taken, to eliminate the hammers and pins, leaving only enough behind the pivots to actuate switches.

Key switches may be made in several ways. Possibly the easiest is to purchase flat relay-contact blades and assemble them in the desired positions, either under the key fronts or above the rear ends of the keys. Guardian Electric Manufacturing Co. makes a contact parts kit (No. 200-3) containing an assortment of blades, contact rivets, washers, and spacers, which is useful for this purpose. Springs and contact strips also may be used, as in the Thyratone. Nickel and phosphor-bronze contact spring wire, available from organ repair men, also may be used to make light and small contacts.

Generator systems should be built and mounted so they can be removed in sections for servicing and adjustment. The logical arrangement is to put the string for each note on a separate chassis, making 12 in all. The chassis need not have sides and skirts; often a simple flat piece of metal makes a fine chassis for this purpose. It is especially worthwhile to mount the parts in such a way as to make it possible to reach them while the organ is operating. Many experiments with values and circuits undoubtedly will be made after the instrument is complete, especially in the tone-coloring section.

The EXPRESSION pedal or pedals and the CRESCENDO pedal, if any, are important design points. Ordinary radio volume controls are not suitable, even though it may be possible to link them to the pedals. The EXPRESSION pedal undergoes hundreds of times as many operating cycles as radio or amplifier controls and must be especially rugged. Whatever control is used must at least be a heavy wire-wound unit. The best type is the contact-stud variety, like a broadcast attenuator, available from General Radio, Daven, Cinema Engineering, and other companies. High-impedance types are usually undesirable because the necessary lines cause high-frequency loss and because any contact disturbance is more obtrusive in a high-impedance circuit. The expression control must not bring the volume down to zero in the minimum position. A range of 30 db or so is sufficient. At the same time the instrument must have some kind of preset volume control so that the maximum volume can be adjusted to suit the room and the listeners.

Separate tone cabinets are superior musically to having the speaker in the console. A speaker cabinet can be designed for good baffling and preferably should be placed in a corner of the room or auditorium, with the speakers facing the corner for good sound dispersion. A better installation method is to have a hard-walled organ chamber, perhaps 10 feet square or more, with the speaker cabinet concealed within it and louvers opening into the auditorium. Excellent results may be obtained also by placing several separate speakers at intervals along the front of the room, but they must be correctly phased to prevent interference.

Answers to some questions

In closing this series it might be well to reply in print to a few of the most-often-asked questions received by the writer. A frequent one concerns making this series material into a book. It is probable that the material, expanded and rearranged, will be published in book form. If and when that is done, announcements will be made.

Requests for full building plans for an organ must be met by a statement that no such plans exist, though they are now in preparation.

Many correspondents ask for more construction details of the commercial instruments described in this series, especially with respect to exact specifications of coils and the like. The descriptive articles were not meant to be construction articles, though the material in them furnishes some excellent design hints. Every scrap of information the manufacturers could be prevailed upon to furnish was published; it is impossible to furnish more.

In concluding the series, the writer would like to express his gratitude to all the readers who wrote in—for their interest and their comments. While the field of electronic music does not interest everyone in electronics, its devotees are indeed enthusiastic. The instruments now available have only scratched the surface of possibilities; in a few years the electronic organ may be as common as the piano in the homes of America, and readers of this series may be among those responsible.

—end—

TAPE RECORDING

By I. QUEEN
Editorial Associate

Tape-threading and transport systems—checking head wear—vital maintenance

PART II

THE tape mechanism is composed of motors, pulleys, cams, levers, and clutches to pull, control, and guide the tape through the machine. Moving parts mean wearing parts, so periodic maintenance is needed. Normally this includes regular cleaning away of dirt and dust, keeping all parts properly lubricated, and replacing worn parts. Most machines are very rugged and seldom need major repairs or replacements. The manufacturer's service data should always be consulted before attempting a major job on the mechanism. Most repairs can be made readily by a technician with average mechanical ability, sufficient service information, and a knowledge of recorders.

Tape transport

Threading a tape is much easier than threading a film projector. In many types of recorders—such as the Brush in Fig. 1—the reels are put in place on their spindles and the tape is simply dropped into the threading slot. It is automatically positioned beneath the cover plates. These protect the mechanism and keep out dirt. Fig. 2 is a view beneath the cover plates of a typical recorder. Coming off the feed reel (not shown) the tape passes first around the erasing head and then the record-playback head. Then it comes around the capstan and is taken up on the other reel (not shown).

During recording and reproducing the right-hand pressure arm holds the tape against the capstan by a pressure roller. The capstan pulls the tape past the heads at uniform speed. The felt pad holds the tape against the head. The pressure arm shown at the left holds the tape firmly against the erasing head during recording. Recorded material is erased automatically before a new recording is made.

Both arms are released during rewind (This is the position the photo shows them in). This leaves the tape free to move rapidly from one reel to the other. Rewind speed may be as fast as 10 times normal (or capstan) speed.

Routine maintenance

After prolonged use, contact surfaces of the erase and record heads accumulate tape particles, dirt, and dust. They should be wiped clean periodically with a dry cloth. If the dirt is hardened, remove it with carbon tetrachloride on a cotton swab at the end of a toothpick or on a folded pipe cleaner. Wipe the surfaces dry after cleaning. *Never use a brush or sharp instrument on the head surfaces.*

The capstan and other metal moving parts may also be cleaned with carbon-tet. *Keep this solvent away from the tape and from rubber surfaces.*

Gears, pivots, bearings, and sliding surfaces should be covered with a thin

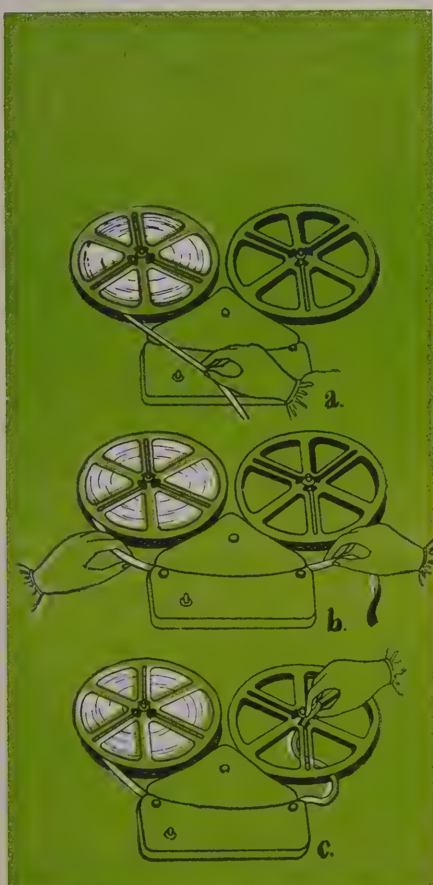


Fig. 1—Semi-automatic tape threading in Brush "Soundmirror" recorders. (a) Tape leader is pulled out. (b) Leader dropped in tape guide slot. (c) Free end locked in takeup-reel perforation.

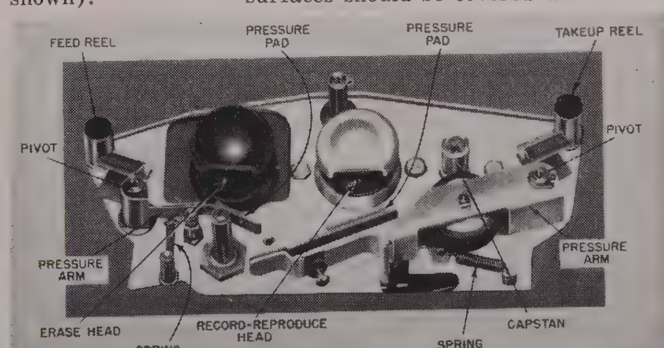


Fig.2—Brush tape-transport mechanism. Functions of parts are explained in text.

Three modern portable tape recorders: Wilcox-Gay (left); Web Cor "Electronic Memory" (center); Brush "Soundmirror" (right). Wilcox-Gay has push-button tape control. All three types have built-in playback amplifiers and loudspeakers.

film of lubricant. Most machines do not need added lubrication for extended periods of time. However, when the parts have been disassembled for replacement or repair, they may be wiped clean of dirt and rubber dust from the belt and then relubricated. Lubrication is also needed whenever any moving parts become noisy or show signs of binding.

Never oil the capstan, motor shaft, or rubber wheel surfaces. Some motors never require oiling. Brush Development Co., recommends oiling its recorder motors once every three months with SAE No. 20 oil. They also suggest a thin coat of light oil for all moving and sliding parts (after wiping free of dirt and rubber dust). Oilite bearings, used in many models, seldom require lubrication. Always consult service data for specific instructions.

Eicor, Inc., suggests the following lubricants for its machines:

Rotating shafts (when being replaced or reassembled)—
  Wipe with lint-free cloth or paper and oil lightly (2 or 3 drops) with Kensington No. 9 spindle oil.

Felt washers on takeup and rewind drums—
  Sta-Put oil No. 360. Saturate washers, then remove as much oil as possible by pressing against cloth or absorbent paper.

Mechanical linkages—
  Sta-Put No. 18-H at points of friction. Lubricate lightly.

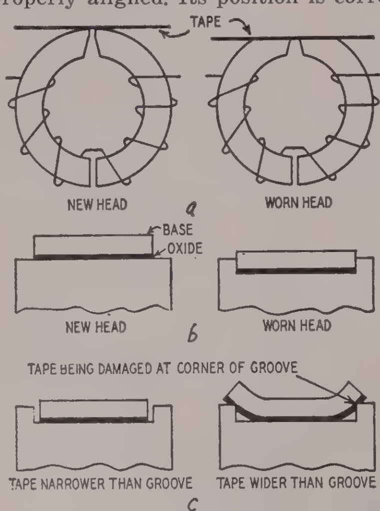
Head adjustments

After prolonged use, the erasing and recording heads show signs of wear and the h.f. response begins to drop off. Fig. 3-a shows how the magnetic gap widens, and 3-b is an exaggerated end view. Note how a groove is worn into the head surface.

The width of new tape normally varies between 0.244 and 0.250 inch. If a relatively wide tape is threaded on a worn head, it will not fit the groove (Fig. 3-c). The h.f. response will be reduced and the tape may be damaged. To prevent this, the head surface may be restored by *lapping*.

Audio Devices, Inc., recommends a Belgian water stone or lightly oiled Arkansas stone. Use only the lightest touch. Lapping prolongs the life of head and tape, but eventually the head will have to be replaced.

When a new head is installed, it should not be tightened in place until properly aligned. Its position is correct when it provides maximum signal and minimum noise. The head should be rocked from side to side while a test tape is pulled through the machine. Output will be maximum when the magnetic gap is perpendicular to the tape. Some machines have a movable piece of mu-metal behind the head or on its pressure arm. This metal is tightened in the position at which least hum is heard. (This hum is often generated by the motor field.)



Courtesy Audio Devices, Inc.

Fig. 2—Effects of tape friction against soft-metal pole pieces. (a) Side views show how wear widens magnetic gap, cuts h.f. response. (b) End view of tape shows groove worn in head with prolonged use. (c) Normal variations in tape width may cause damage from groove edges.

Correct head positioning is essential for highest fidelity. In broadcast stations the head is realigned daily for maximum output while a standard test tape runs through the recorder. As mentioned previously, a worn or poorly adjusted head shows up in loss of h.f. response.

With a properly balanced erasing circuit, hiss will be at a minimum. The erasing head may be checked from time to time for correct h.f. current and voltage as specified by the manufacturer. A magnetized head may generate considerable noise. *Keep all magnets or magnetized tools away from the heads.* A head may be demagnetized by inserting it in a coil carrying a.c. Remove slowly while current continues to flow. Some manufacturers recommend periodic head demagnetization to maintain a low noise level.

After several hundred hours use, pressure pads may need replacement. These may be attached with a quick-drying cement. After replacement, the pad pressure should be checked against service data. Insufficient pressure causes loss of h.f. because the tape does not contact the head as it should.

Mechanical troubles

In several respects *mechanical* troubles require a different procedure than *electronic* breakdowns. The mechanical defect is often easier to locate. For example, mere inspection may disclose a loose spring, bent lever, or worn cam. On the other hand, defective mechanical parts are generally more difficult to remove and replace. Removal of a shaft or lever must follow definite service directions and a study of an "exploded view" diagram.

Mechanical parts should be replaced with identical components. Most manufacturers design and make parts for their own machines, so substitutes are seldom available.

Often it is more convenient to replace

TABLE I
RECORDER TROUBLE CHART

Trouble	Cause
Distortion	Incorrect head adjustment Dirty record-playback head Incorrect h.f. bias Incorrect pad pressure Overmodulation during recording Equalizer defect Worn head
No erase	Dirt on head Insufficient erasing current Low pad pressure
Weak output	Incorrect head adjustment Low modulation during recording Incorrectly wound tape
Wow	Defective capstan or drive Bent reels Too much pad pressure Oil on capstan or drive
Noise, hiss	Magnetized record head Misadjusted mu-metal shield Unbalanced erasing circuit

an entire subassembly than individual parts. This saves considerable repair time and usually guarantees more satisfactory performance.

As with the electronic circuits, each tape mechanism differs in some ways from others. Some manufacturers include special mechanical features to simplify the machine and perhaps reduce cost. Others include features for more convenient operation, increased efficiency, or improved performance. These special features, rugged construction, improved performance, all determine final cost.

Tape speed is an important consideration. Some machines have two or even three speeds. Low speed is desirable for lengthy speech programs. High speed is necessary for high-quality music.

Small machines generally have a single motor. Others include two or even three motors to distribute the load and assure minimum speed variation. The better machines have a wow of less than 0.5%. The Web Cor 210 has two separate motors, two separate drives, and associated parts. One motor drives the capstan only. The other controls the takeup and may be switched to either reel depending on the direction of tape travel desired. This model also has two separate recording heads. Either track may be used without rewinding the tape.

Push-button control is used on some recorders, among them Wilcox-Gay and Revere.

A trouble-shooting chart appears in Table I. It does not include ordinary amplifier defects.

TABLE II
TAPE WINDING IN COMMERCIAL RECORDERS

MANUFACTURER AND MODEL OR TYPE OF TAPE RECORDER	B	A	MANUFACTURER AND MODEL OR TYPE OF TAPE RECORDER	B	A
Ampex — Models 400 and 300C	□	■	Magnecord — All Models	□	■
Amplifier Corp. — All "Twin-Trax" Models	■	□	Operadio — "Du-Kane"	■	□
Ampro Corp. — "Ampro-Tape"	□	■	Pentron — All Models	□	■
Bell Sound Systems—"Re-Cord-O-Fone"	□	■	Permoflux — "Permoflux Scribe"	□	■
Berlant Assoc. — "Concertone"	□	■	Presto — All Models	□	■
Brush — "Soundmirror"	□	■	Rangertone — Models R-5P and R-5C	□	■
Califone Corp. — "Dynacord"	■	□	RCA — Models RT-11A and RT-12A	□	■
Crestwood — "Magictape"	■	□	Revere — All Models	□	■
Eicor — Model 115	□	■	Sonar — Model PTM	□	■
General Industries — Tape-Disc Recorder	□	■	Stancil-Hoffman — "Minitape" and Model R-4	□	■
Fairchild — Console Models	□	■	Universal Electronics — "Reelest"	■	□
Macon Electronics — "Musictape"	□	■	Webster Chicago — "Web Cor"	□	■
Magnetic Recording Ind. — VM-55, VM-56, VM56SS	□	■	Webster Electric — "Ekotape"	□	■
Mark Simpson — "Masco"	□	■	Wilcox-Gay — "Recordio"	□	■

Courtesy Audio Devices, Inc.

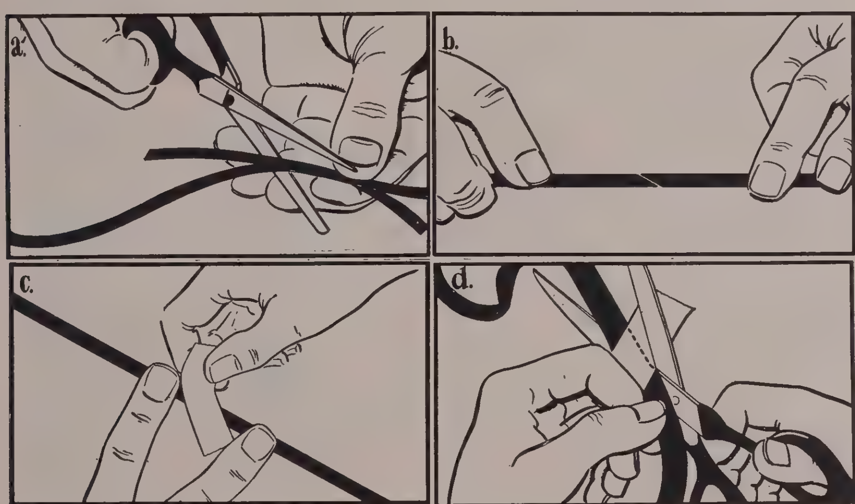


Fig. 4—Correct tape-splicing procedure. Ends are cut at 60-degree angle with *unmagnetized* scissors, butted as shown, and spliced with cellophane adhesive tape. Commercial splicing jigs are available for high-speed quantity output.

Fig. 5—Leader tape protects recordings, has alternate colored 3½-inch sections for timing program intervals and tape labeling.

Tape data

Many companies sell magnetic tape. Some are listed here, together with their trade-names.

Amplifier Corp. of America	Magneribbon
Audio Devices, Inc.	Audiotape
Brush Development Co.	Magic ribbon
Minnesota Mining & Mfg.	Scotch
Reeves	Soundcraft
Webster-Chicago	Web-cor
Permo, Inc.	Permo

A red-oxide (medium coercive-force) coating is recommended by practically all recorder manufacturers. This coating is available on either a paper or plastic base. The latter is more expensive but has a noise level about 10 db lower and is more durable.

Tape is always run with the uncoated side (shiny on plastic; grey or brown on paper) *away from* the erasing and record-reproducing heads. Therefore the tape winding depends upon whether the feed reel unwinds clockwise or not and whether the tape passes over or under the heads. Type A wind means that the tape is wound with coating toward the reel center. Type B has the coating away from the reel center. Table II lists a number of tape-recorder manufacturers and the winding type required for their products.

Fig. 4 shows the four steps needed to splice tape. This method assures a noise-free splice that will not come apart. The tape ends are cut at about a 60-degree angle, using an unmagnetized pair of scissors. With *uncoated side up*, they are then aligned without overlapping and without space between them. Next, splicing tape (for example, Scotch No. 41) is wrapped around the ends. Finally the edges are trimmed near the splice (dotted lines).

Tape should not be subjected to high temperature or humidity. Room temperature and 40-60% humidity are recommended. Tape stored for longer than six months should be rewound before playing. This safeguards against any tendency for adjacent layers to stick together. When tape is to be stored for five years or longer, a movie-type can is suggested.

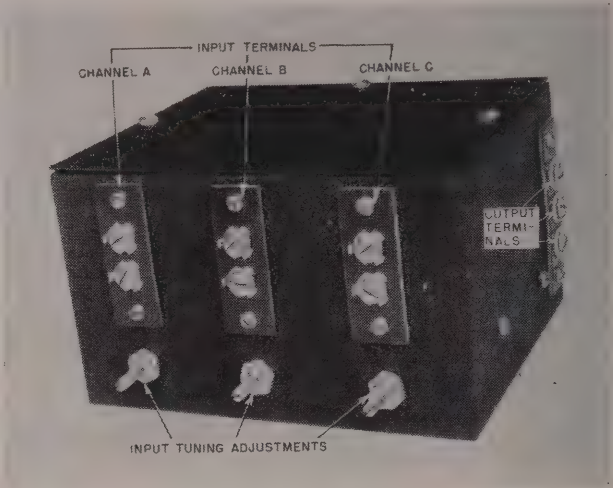
For convenience and protection special leader and timing tape may be added at each end of a roll. Scotch No. 43 is a tough, plastic-treated, white-paper tape excellent for the purpose. It is printed in alternate sections of plaid and white (Fig. 5). The tape serves a triple purpose: It is a leader to protect the tape ends. It times the interval between recorded sections. (Each plaid or white section corresponds to 1 second at 3.75 i.p.s.) Finally, the white sections may be labeled in ink to identify recordings.

—end—

Get rid of haywire and awkward input switching with this

TV ANTENNA COUPLER

By EDWIN T. BOHR



Coupler antenna terminals and input-tuning adjustments.

THIS coupler does away with TV-antenna switching, provides high-gain boosting, and couples as many as three TV signals into a single transmission line. It can easily simplify many complicated antenna systems.

For example, in an average TV location where a booster is needed, reception is usually possible from no more than two or three channels. If the stations are in different directions, or if Yagis are used, the antenna, the booster, and the TV set must be switched when channels are changed. This is not only cumbersome but extremely embarassing for dealers trying to demonstrate receivers under these conditions. With the channel coupler a salesman or a housewife can change stations by simply flipping the receiver channel selector. The channel coupler also can be used ahead of distribution units—either the resistor-pad type or vacuum-tube type.

Because the channels are amplified separately, the coupler gives the convenience of an all-band booster with much higher gain. By tying two of the inputs in series, the coupler becomes a pre-set two-channel booster.

The three signal outputs are combined in a common 300-ohm circuit to the receiver.

Coupler circuit

After considerable research and experiment, the familiar cascode circuit of Fig. 1 was adopted. The gain of the first stage is negligible, so there is no danger of oscillation. (Neutralization would give slightly lower noise on the high channels.)

No tuned circuit or choke is used between stages on the low channels. The grounded-grid second stage presents a very low input resistance to the first stage. Since the input capacitance is also low, a resonating coil on the low channels is not necessary and is eliminated to simplify construction. On the high band L5 is used to cancel the interstage capacitance. One value of inductance serves channels 7–13. The second-stage grid is grounded for r.f. by the .0015-μf capacitor, and returned to the cathode for d.c. through the 470,000-ohm resistor.

Coil data

The input and output circuits have slug-tuned coils that resonate with the tube and circuit capacitance.

These are wound on ⅜-inch diameter slug-tuned coil forms such as the Cambridge Thermionic type LS-3. For channels 2, 3, and 4, the coils are wound with No. 26 enameled wire.

For the other channels, No. 16 enameled wire is used for the grid and plate coils; L1 and L4 are stranded thermoplastic hookup wire wound over L2 and L3. This can be seen in the photographs. The winding data follows:

Channel	TURNS			
	L1	L2	L3	L4
2	3	10	12	3
3	3	9	11	3
4	3	8	10	3
5	3	8	9	3
6	2	7	8	2
7	1½	3	3½	1
8	1½	3	3½	1
9	1½	3	3½	1
10	1½	2½	3	1

Use the channel 10 data for channels 11, 12, and 13, spacing the turns slightly for the correct tuning range. L5 is 8 turns of No. 16 enameled wire, ¼ inch in diameter, self-supporting.

For channels 2, 3, and 4 the output coil (L4) should be insulated from the plate winding (L3) by a piece of Scotch electrical tape, since the enamel insulation breaks down easily at 200 volts.

Wind L1 and L4 on top of L2 and L3 at the *ground ends* of these coils (*away from* the grid or plate ends). Tight coupling at the ground end of the coil gives the lowest susceptibility to noise and interference picked up by the transmission line.

Each antenna coil (L1) should be center-tapped.

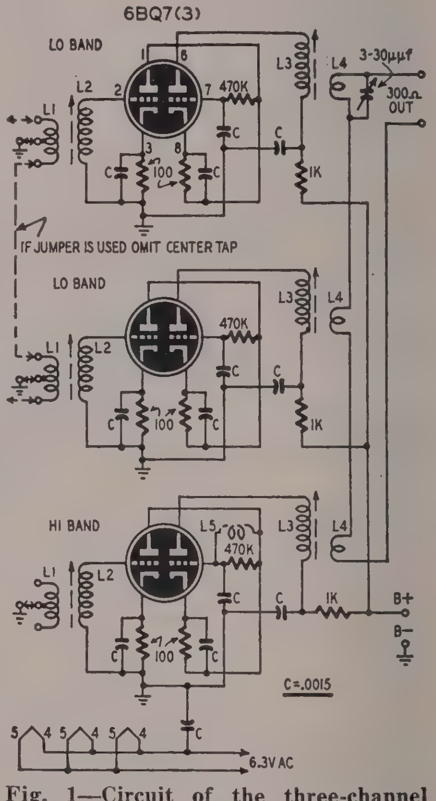


Fig. 1—Circuit of the three-channel coupler-booster. The jumper between the low-band input coils is for use with a common dual-channel antenna.

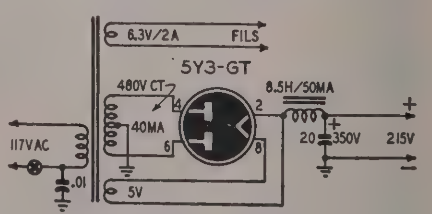
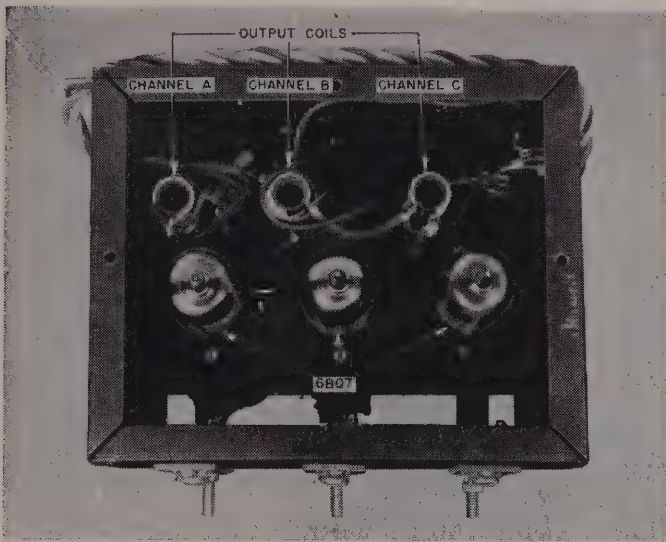
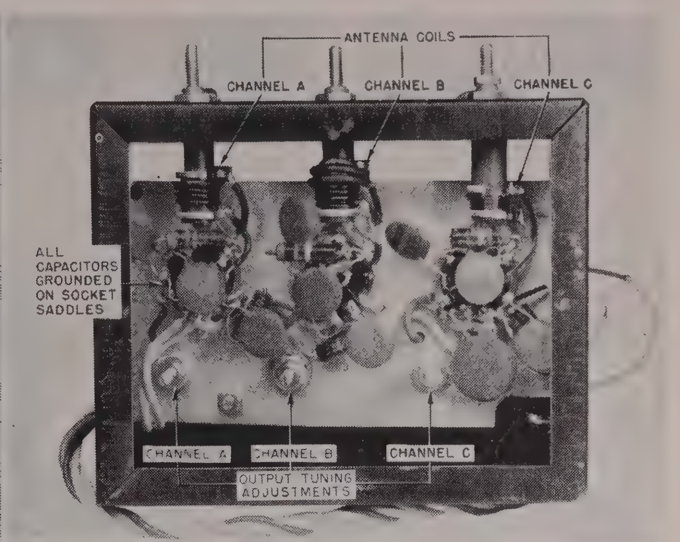


Fig. 2—Schematic of the power supply.



The completed coupler with top and bottom covers removed.



Components and wiring under the chassis.

To obtain maximum tuning range the coils should be wound on the end as far away from the slug as possible. This gives the greatest change in permeability when the slug is screwed into the coil.

The total tube and wiring capacitance across the coil is only about 4 μμf. Additional capacitance—even 1 μμf—can change the tuning range considerably. Use every precaution in winding and installing the coils to keep stray capacitance at a minimum.

Construction

The layout of the channel coupler is shown in the photographs. All capacitors are grounded directly on the socket saddles. Mounting the input coils on the front of the cabinet gives short, direct leads to the tube sockets. The output coils are mounted on the chassis at right angles to the input coils to minimize inductive coupling. The 3–30-μμf trimmer shown in the diagram was not in use when the photographs were taken. It is mounted on top of the chassis behind the lowest-frequency-channel output coil, and is adjusted at the time of installation through a hole drilled in the back of the cabinet.

The metal box is just high enough to accomodate the tubes and the components below the chassis. Mount the chassis so the exhaust tips of the tubes clear the top by about ⅛ inch. The compactness of the coupler may not be apparent from the pictures. It will nest easily in one hand.

Where continuous operation is expected, four ¾-inch holes should be punched in the removable top and bottom plates. With this type of enclosure the top and bottom of the coupler are easily accessible.

The chassis and cabinet, of course, do not have to be exactly like the ones used in this model, as long as the layout and wiring are kept compact and follow the same arrangement.

A separate power supply (Fig. 2) is used with the coupler. A 40-ma replacement type transformer is suitable for continuous operation since each 6BQ7 requires only 10 ma plate current and 0.45 amp heater current. The choke-input filter reduces transformer heating. These components cost less than a comparable selenium-rectifier power supply and provide desirable isolation from the power line.

Installation and tuning

If the channel coupler works best with any of the tuning slugs screwed completely in or completely out, the full channel may not be within the tuning range of the coil. If the gain is maximum with the slug all the way out, reduce the inductance by spreading the turns of wire or by removing a small portion of the coil. If the gain is greatest with the slug completely inside the coil, inductance should be added by squeezing the turns together or by adding a turn (on the low band only). With the correct inductance there is a broad but very definite peak as the slug is turned in or out. The final step is to tune the antenna and plate coil slugs for maximum signal on each channel.

When two inputs are tied together for use with a common antenna, as shown in Fig. 1, the center-taps of the *connected* coils *should not* be grounded. To simplify this change-over, the input terminals shown in the photographs should be replaced with three-terminal strips, and a grounding screw should be mounted on the case as close as possible to each center terminal. A short link between the center terminal and ground can be added or removed as required.

Output coupling

The output windings of the three individual booster circuits are simply connected in series. Each coil offers an appreciable impedance only over the frequency band to which the plate winding is tuned.

Suppose the coupler is used to combine channels 2, 5, and 8. Here is what happens: The signal from the channel 2 booster is fed to the line in series with the channel 5 and channel 8 coils. These two coils (5 and 8) offer negligible impedance to the lower-frequency signal. The high reactance of the channel-2 coil on the higher frequencies is tuned out with the 3-30 μμf ceramic trimmer capacitor. This adjustment is not critical. It can be peaked on channel 2, since it is needed only to balance the inductance of the coil.

Applications

The channel coupler can simplify many knotty antenna systems. With one of these units you will wonder how you ever put up with a conglomeration of wires, boosters, and switches. A TV-set salesman will no longer need to blush and flip five switches to change a channel.

The channel coupler can obviously be built with only two sections; or a single section may be built for use as a simple booster. Its versatility is unlimited.

(In some applications it may be possible to improve the impedance match between the booster output and the receiver input by inserting suitable resistors in each output lead. Various values can be tried until the best overall performance is obtained, or until a particular channel is brought in with the proper relationship between sound and picture.—*Editor*)

Materials for channel coupler

Resistors: 6—100 ohms, 3—1,000 ohms, 3—470,000 ohms, ½ watt.
Capacitors: (ceramic) 13—.0015 μf, 1—3-30 μμf trimmer.
Miscellaneous: 3—6BQ7 tubes, 3—9-pin miniature tube sockets, 6—slug-tuned coil forms (Cambridge Thermionic Type LS-3 or equivalent), terminals, connectors, chassis, cabinet, wire, solder, hardware.

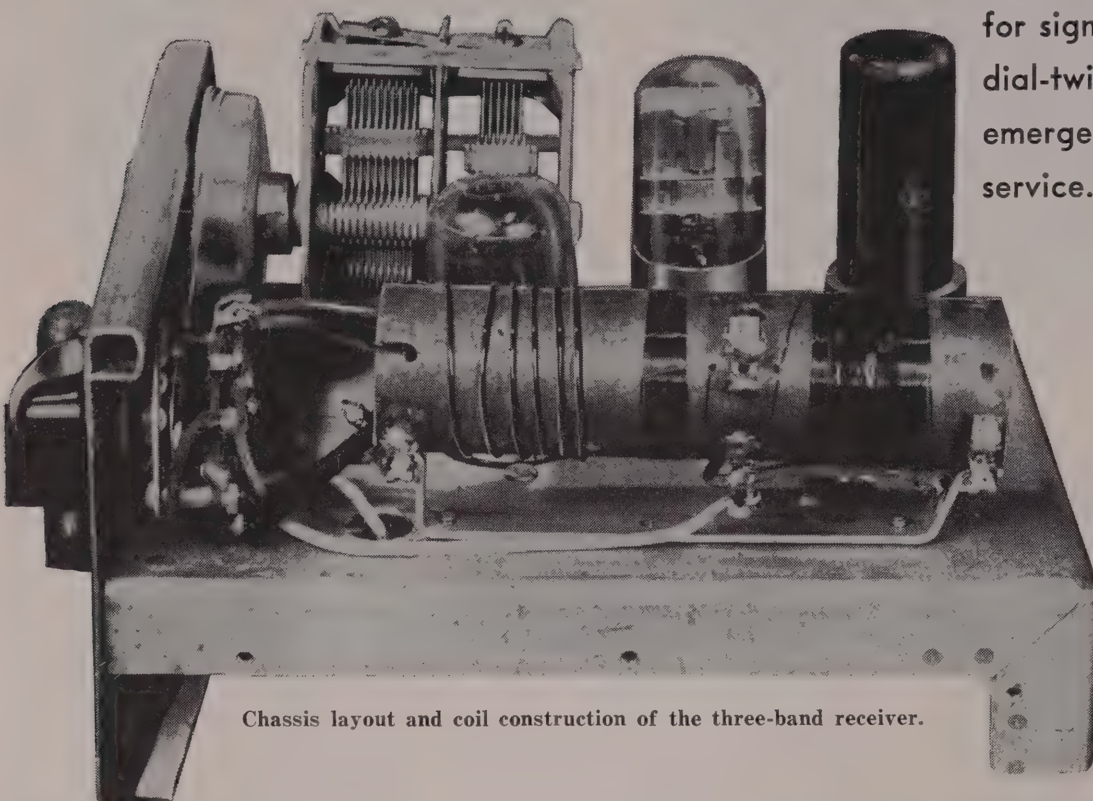
Materials for power supply

Miscellaneous: 1 power transformer, 480 volts c.t., 40 ma, 5 volts, 2 amp, 6.3 volts, 1.5 amp; 1 filter choke, 8.5 henries, 50 ma; 1—5Y3-GT; 1—20-μf, 350-volt electrolytic capacitor; 1—.01-μf, 600-volt paper capacitor; 1—s.p.s.t. toggle switch; 1 octal socket; chassis; terminals; wire; solder; hardware.

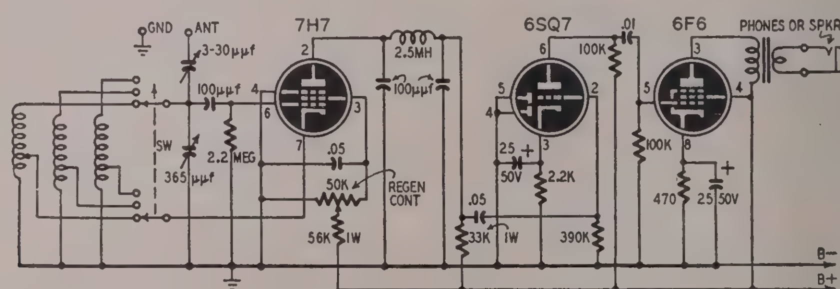
—end—

BANDSWITCHING REGENERATIVE RECEIVER

A handy, compact unit for signal monitoring, dial-twirling, or emergency standby service.



Chassis layout and coil construction of the three-band receiver.



The receiver schematic. Power supply requirements are 6.3 v (a.c. or d.c.) at 1.3 amp; 180-250 v d.c. at approximately 50 ma. Any single-wire antenna will do.

By C. TIERNEY

THE three-tube receiver pictured here has the advantage of bandswitching and can be built with a minimum of parts. The 7H7 loktal detector gives high gain with low losses.

The chassis is 7½ inches deep, 6 inches long, and 1½ inches high. The coil has three windings, one for the broadcast band, one for frequencies between 1500 kc and 4 mc, and one for frequencies between 6 and a little below 16 mc. The coil form is 4½ inches long and 1¼ inches in diameter, with soldering lugs attached in favorable positions for coil lead terminations.

Turns for the bands are: Broadcast, 85 turns, tapped 6 from ground; 160-75 meters, 25 turns, tapped 3½ from ground; 20-meter band, 6 turns, tapped 2 from ground.

The 20-meter winding is spaced over an inch, and is wound with No. 24 enameled wire. The other two coils are close-wound with No. 30 enameled wire. The photo shows position and spacing of all windings. If the detector refuses to oscillate, move the tap a turn or two up the coil.

Put the 20-meter winding nearest the switch, where it will have the shortest leads, put the 160–75 meter winding in the center of the form, and the broadcast coil farthest from the panel. Make all leads from the coil to the switch as short as possible, bringing most of them through the coil form. Except for the leads from the tube's grid and cathode, all coil wiring is above the chassis.

A dial for this receiver can be calibrated by beating the receiver with a calibrated all-wave set. With the two receivers operating beside each other, and the regeneration control up on this set, a loud whistle will be heard from the all-wave set's speaker when the two sets are tuned to the same frequency. If the calibrated set is a super het, be sure not to zero beat on the image frequency.

Materials for Receiver

Resistors: 1—33,000, 1—56,000, 1—470 ohms, 1 watt; 1—2,200, 2—100,000, 1—390,000 ohms, 1—2.2 megohms, ½ watt; 1—50,000-ohm potentiometer.

Capacitors: 1—365 μμf, variable; 1—3-30 μμf, mica trimmer; 3—100 μμf, mica; 1—.01, 2—.05 μf, paper; 2—25 μf, 50-volt electrolytic.

Miscellaneous: 1—2-pole, 3-position rotary switch; 1—output transformer, 6F6 to voice coil; 1—open circuit jack; 1—7H7, 1—6SQ7, 1—6F6 tubes, 1—2.5-millihenry radio-frequency choke; coil form; No. 24 enameled wire; No. 30 enameled wire; chassis; dial; control knobs; hookup wire; solder; terminals; hardware; sockets.

—end—

ELECTRONIC MULTIMETERS

Electronic multimeters are rapidly replacing the volt-ohm-milliammeter which was formerly the most widely used instrument in service shops, electronic laboratories, schools, and ham shacks. The most common type of v.t.v.m. or electronic multimeter uses two triodes in a bridge circuit with the meter arranged to read the difference in cathode currents. A typical circuit of this type (Fig. 1) is reprinted from *La Radio Revue* (Antwerp, Belgium).

Constructed around a 400-μa, 500-ohm meter, the instrument measures a.c. and positive or negative d.c. volts in full-scale ranges of 3, 10, 30, 100, 300, 1,000, and 3,000; and resistances from 0.5 ohms to 500 megohms in four ranges.

Fig. 2 shows how the 4¾-inch rectangular meter is calibrated. Three scales are used for voltage measurements and one for resistance. The lower voltage scale has a center zero for discriminator alignment and is not directly calibrated. Your local photostatter or photographer can enlarge or reduce the scale to fit your meter.

The RANGE and FUNCTION SELECTOR switches and the OHMS ADJ and ZERO controls are on the front panel. The CALIBRATE and AC BALANCE controls are mounted on the chassis since they are used only during initial calibration.

The ZERO control sets the pointer to the extreme left of each range for voltage and resistance measurements and to the center zero for discriminator alignment. Adjust the AC BALANCE control so the zero does not shift when switching from a.c. to d.c. volts. If the balance point cannot be found, try different values for R1. The CALIBRATE control is used to set the pointer exactly on 3 volts with a fresh 3-volt battery connected to the d.c. input terminals and the meter set on the 3-volt range. Set the OHMS ADJ control so the pointer is on the last (infinity) division of the resistance scale before connecting the resistance to be measured.

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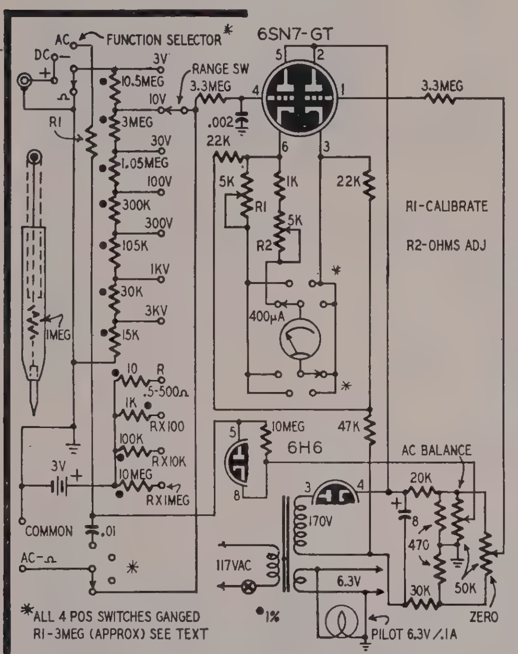
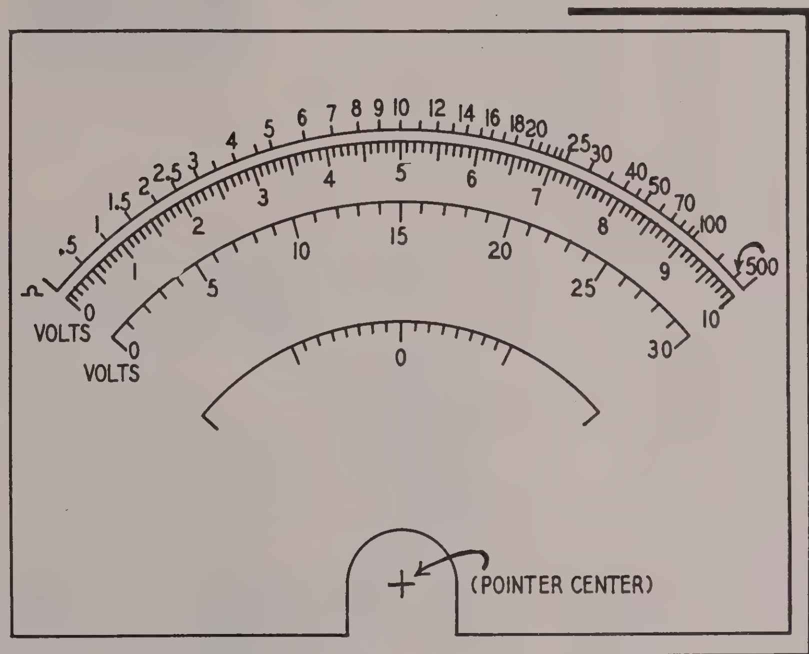




SUPERSENSITIVE PILOT RELAY

The novel electronic pilot relay shown in the diagram is designed around the new TT-1 cold-cathode control tube manufactured by Haledy Electronics Co., of 57 William St., New York, N. Y. Requiring only 2 μa through the control contacts, the unit is adaptable for machinery control, automatic counting, meter relays, liquid flow meters, strain gauges, and other applications where the external contacts would be damaged by normal control currents.

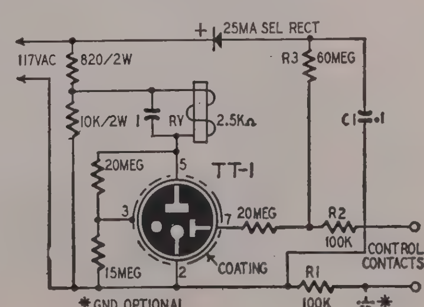
The TT-1 differs from the 0A4-G in several respects. It has a sprayed-on external electrode which connects to a high-resistance voltage divider between plate and cathode. It is many times more sensitive than the 0A4-G and its starter anode must be *negative* with respect to the cathode to initiate the glow discharge which causes current to flow in the plate circuit.

The starter anode is the control element. It is biased highly negative by the charge placed on C1 by the rectifier. The starter anode must be at least 20 volts negative with respect to the cathode to initiate the glow discharge. If the control contacts are shorted or connected through a resistance of less than 10 megohms, the starter-cathode potential will not be high enough to produce a glow discharge.

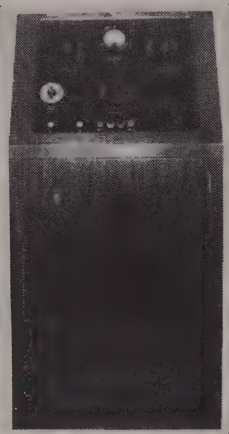
The voltage across the capacitor, about 120 volts, appears across a voltage divider consisting of R1, the resistance across the control contacts, R2, and R3. Since the starter connects to the cathode through R1, R2, and the resistance across the contacts, the total resistance in the starter-cathode circuit must be high enough to raise the starter-cathode voltage to the discharge point.

The minimum resistance required for firing the tube can be raised or lowered by varying the values of R2 and R3.—*Edward Spierer and Harry Peach.*

(Experimenters may use a 1C21 or 0A4-G in this circuit if they use a sprayed-on graphite layer as the external electrode as described in the article, "Increase Sensitivity of Cold-Cathode Tube" on page 102 of the February, 1951, issue.—*Editor*)



FREQUENCY STABILIZED DIATHERMY



A tested design that meets stringent FCC requirements for interference-free operation.

By IRVING GOTTLIEB

THOUSANDS of diathermy machines were rendered obsolete by the Federal Communications Committee's ruling, July 1, which made frequency stabilization mandatory. A great deal of enthusiastic effort has been directed to converting existing sets to crystal control. These endeavors invariably resulted in technical frustration and financial disappointment.

The typical diathermy apparatus generates several hundred watts of high-frequency energy with a pair of medium- or low-mu triodes connected as a self-excited oscillator and powered by raw a.c. At first glance, it would appear to be possible to convert the oscillator circuit to a neutralized class C amplifier driven by a crystal-controlled exciter. Actually, this method is impractical in most instances. The triodes are difficult to neutralize because of the wide range of load conditions and require considerable grid power from the exciter. Since r.f.-bypass and tank circuit-resonating capacitors are absent in the majority of sets, redesign of the tuned circuits is necessary. Usually the cabinet will not accommodate such components, not to mention a bulky exciter unit and power-supply apparatus. (The same FCC stipulation makes filtered d.c. a requisite.) As a consequence, "conversion" actually means complete rebuilding of the equipment, including construction of a new cabinet.

The author experimented with cathode-follower amplifiers, grounded-grid circuits, and synchronized oscillators. These gave satisfactory performance when judged against amateur transmitter requirements. However, no arrangement could be passed as foolproof for service in the workaday world of medical therapy, which does not include supervision by an electronic technician. Clearly, a new and unique approach is indicated, one which will put in the physician's hands a reliable diathermy machine reduced to the lowest terms of engineering simplicity, and without compromise of performance.

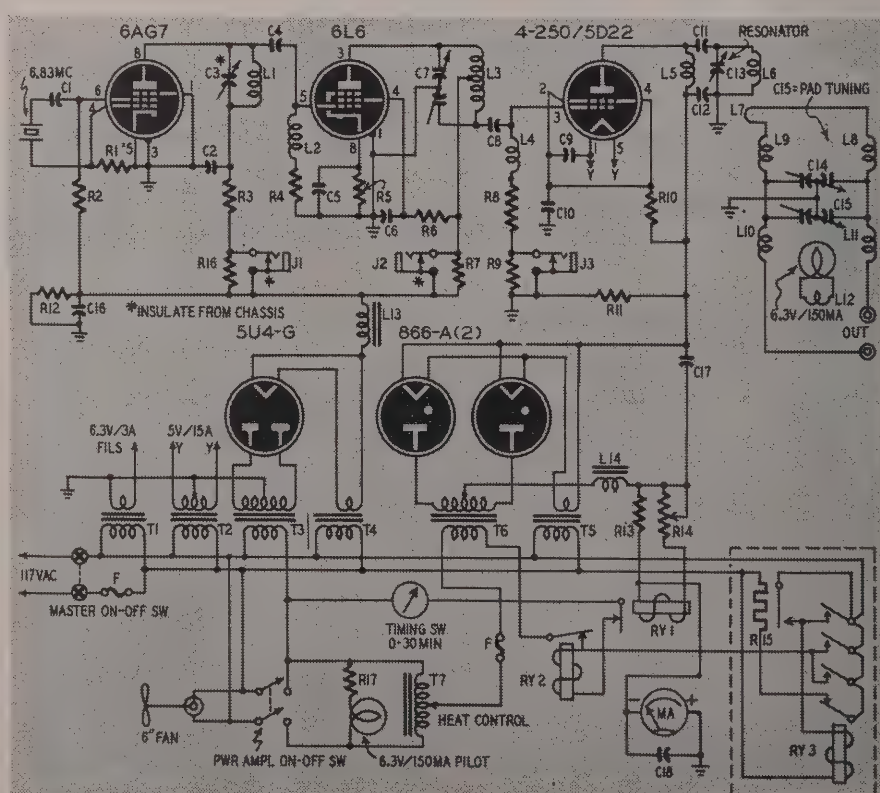
Use a tetrode

Fortunately, there is an excellent solution to the problem. The Eitel McCullough Co. (and others) make a series of r.f. power tetrodes which deliver up to 500 watts output when driven by a small exciter made from receiving-type tubes and parts. Neutralization is either unnecessary, or extremely easy. Only one such tetrode is required. These tetrodes are physically small compared to the triodes in existing diathermy sets and are better suited for high-frequency operation. They are usually less expensive than the pair of old-fashioned triodes which would be needed to furnish a comparable power output.

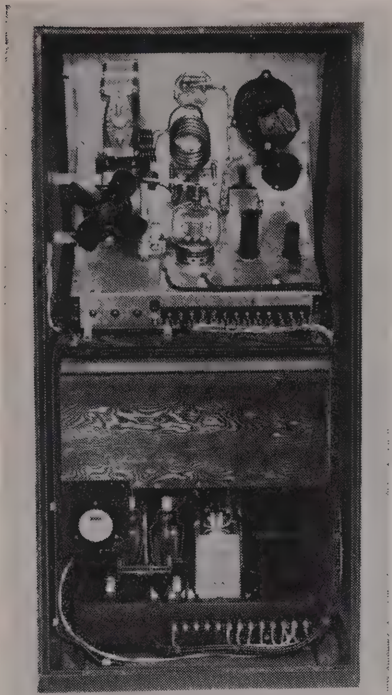
The three tubes best suited for application in crystal-control diathermy are the 4-250A/5D22, the 4-125A/4D21, and the 4-65A with plate dissipation ratings of 250 watts, 125 watts, and 65 watts respectively. The set described uses the 4-250A and can deliver power in the vicinity of 500 watts. This power capability is greater than that of the average self-excited diathermy equipment; accordingly, if a smaller output is suitable, one of the smaller tetrodes may be used, with a saving in tube and power-supply expenditure. The 4-125 will furnish output power comparable to most of the older diathermy sets, and the 4-65A will generate enough power to be useful for many therapeutic applications. The basic design is the same for any of the three tubes, it being necessary only to provide the appropriate filament and plate supplies.

A tested model

The photographs show a 500-watt set built and tested in the engineering lab-



Schematic of the crystal-controlled, 500-watt diathermy set developed by Eimac.



Rear view of the installed diathermy machine, showing how the separate r.f. and power-supply chassis are mounted.

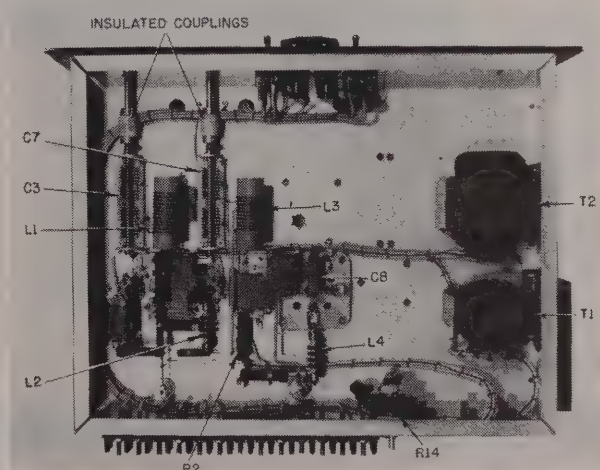
oratory of the Eitel McCullough plant. The power output is made continuously variable with a primary-circuit Variac. No neutralization is required for the output frequency of 27.32 mc. This is the most popular of the short-wave frequencies allotted for diathermy purposes. Once tuned for resonance, the plate tank capacitor need not be further adjusted for any load conditions. Either of the other two frequencies 13.66 or 40.98 mc, can be used by making appropriate changes in the exciter and output tank circuits. The highest frequency can be attained by tripling in the oscillator and doubling in the driver stage. There is still sufficient drive to excite the power-output stage to full output.

The circuit (see the schematic diagram) is straightforward and involves no trick circuits. In addition to good layout and wiring practices, it is necessary to provide about 5 cubic feet of air per minute to cool the base of the 4-250A. A 6-inch fan produces the required convection and cools the power-supply components as well. Good high-frequency practice calls for several special considerations when dealing with r.f. power tetrodes. High-frequency components which precede the tetrode should be located beneath the chassis, and the filament and screen bypass capacitors in the tetrode stage must be grounded as directly as possible.

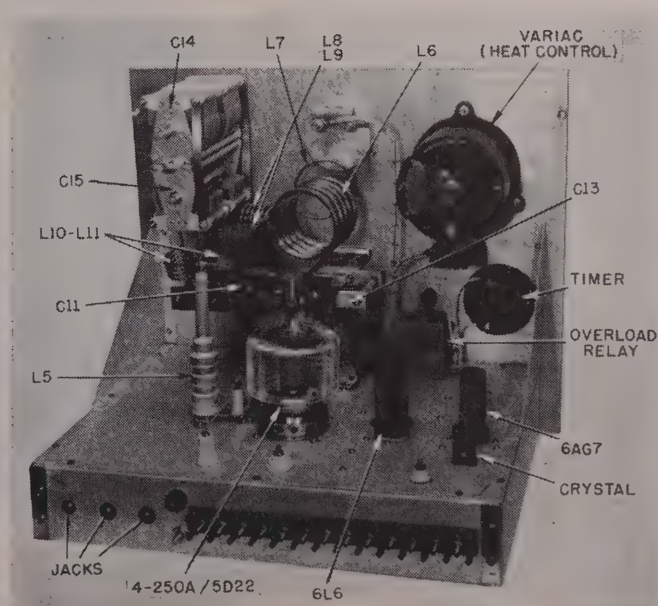
The exciter consists of a 6AG7, connected as a combined Pierce oscillator and frequency multiplier, and a 6L6 frequency multiplier and driver. With a 6.83-mc crystal, the 6AG7 output tank circuit is tuned to the second harmonic, 13.66 mc. This is again doubled to 27.32 mc by the 6L6 stage, enabling the 4-250A tetrode to operate as a straight class C amplifier. The 6L6 should be the metal-envelope type to prevent capacitive coupling to the plate circuit of the tetrode output stage. The same applies to the 6AG7 tube. The r.f. choke in the plate circuit of the tetrode output stage must not have excessive distributed capacitance and must not be mounted closer than two-and-a-half diameters to metallic objects. Observance of these points results in a smooth-operating class C output stage which requires no neutralization over the entire range of load conditions.

Several of the circuit features are due to the special demands of the practice and technique of diathermy. A load coupling network consisting of L7, L8, L9, L10, and L11 and capacitors C14 and C15 permits tuning for efficient power transfer under widely varying load resistance and reactance conditions. Only C15 is adjustable from panel; C14 is initially adjusted to give proper tuning range of C15. A small pilot lamp is inductively coupled (by L12) to the outgoing leads and provides visual guidance in resonating the patient. A 0-500-ma meter in the tetrode plate circuit indicates the degree of loading, which is controllable by a Variac in the primary of the high-voltage supply. Operating instructions should clearly explain the proper sequence of adjustment: the patient is "tuned in" by varying C15, with the power-control Variac set at a low level. Then the Variac is advanced to a higher power level. The experienced therapist or physician can readily correlate the plate-meter reading, the patient's reaction, and his own experience with diathermy techniques, to give a specific therapeutic treatment. A timing switch automatically regulates treatment duration from one to thirty minutes when desired.

Included also are an overload relay (RY-1) and a time-delay relay (RY-3). The overload-relay reset button is mounted on the control panel so that operation is easily restored following an interruption, such as might be caused by bringing the treatment pads too close to one another. The time-delay relay should allow the filaments of the high-voltage rectifiers about three min-



Under the r.f. chassis. T1 and T2 cut power losses by keeping high-current filament leads short. Note professional-looking layout and wiring.



The r.f. unit and control panel. All parts are standard commercial types. Forced-air cooling prolongs tube life.

utes heating time before application of the plate potential. The pads and output cords should be obtained from one of the reputable manufacturers of therapeutic apparatus, such as the H. Fischer Co., of Chicago.

Anyone with experience in constructing and operating medium and high power transmitters should be able to build diathermy sets. The design and performance of this diathermy will merit FCC approval. Here then, is an excellent opportunity for the enterprising would-be-manufacturer who has been seeking a way to capitalize on his knowledge, for the diathermy machine market is now wide open.

References:

Bulletin No. 1; Eitel-McCulloch Inc.
Crystal-Controlled Diathermy; R. L. Norton. *Electronics*, October, 1946.

PARTS LIST

Capacitors

C1—.002, mica.
C2—.002, mica, 600 volts.
C3—60 μμf, variable capacitor.
C4—.001, mica, 600 volts.
C5—.004, mica.
C6—.004, mica, 600 volts.
C7—split-stator variable capacitor, 30 μμf per section.
C8—.001, mica, 600 volts .
C8—.0001, mica, 600 volts.
C9—.002, mica, 5,000 volts.
C10—.002, mica, 5,000 volts.
C11—.002, mica, 5,000 volts.
C12—.002, mica, 5,000 volts .
C13—50 μμf, transmitting-type tuning capacitor (0.1 inch minimum plate spacing).
C14—split-stator variable capacitor, 100 μμf per section (0.1 inch minimum plate spacing).
C15—Same as C14.
C16—2 μf, 600 volts, oil-impregnated paper.
C17—2 μf, 3,000 volts, oil-impregnated paper.
C18—.01 mica.

Resistors

R1—51,000 ohms, 2 watts, carbon.
R2—30,000 ohms, 10 watts, wire-wound.
R3—8,000 ohms, 10 watts, wire-wound.
R4—100,000 ohms, 2 watts, carbon.
R5—500 ohms, 10 watts, wire-wound.
R6—30,000 ohms, 10 watts, wire-wound.
R7—100 ohms, 2 watts, carbon.
R8—10,000 ohms, 10 watts, noninductive wire-wound.
R9—100 ohms, 2 watts, carbon.
R10—25,000 ohms, 100 watts, wire-wound.
R11—Two 100,000-ohm, 50-watt, wire-wound resistors in series.
R12—50,000 ohms, 25 watts, wire-wound.
R13—100 ohms, 10 watts, wire-wound.
R14—100 ohms, 25 watts, adjustable, wire-wound.
R15—Heater in time-delay relay.
R16—100 ohms, 2 watts, carbon.
R17—750 ohms, 10 watts, wire-wound.

Miscellaneous

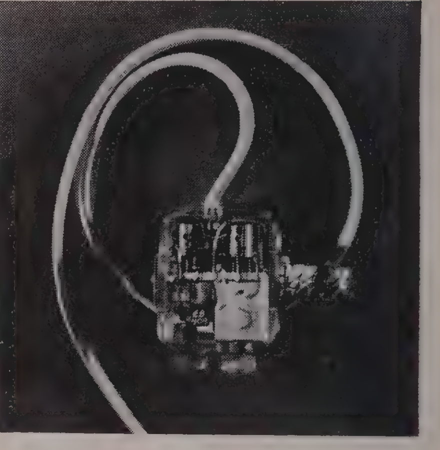
T1—Filament transformer—6.3 volts, 3 amps.
T2—Filament transformer—5 volts, 15 amp.
T3—Power transformer—1,050 volts, center-tapped, 150 ma.
T4—Filament transformer—5 volts, 3 amps.
T5—Filament transformer—2.5 volts, 10 amp.
T6—Power transformer 6,000 volts, center-tapped, 150 ma.
T7—Variac—800 volt-amperes.
Ma—0-500 d.c. milliammeter.
Timer—Rotary timing switch such as manufactured by the Haydon Mfg. Co. Timing duration 1 to 30 minutes.
Time-delay relay—Can be either thermal or clock motor type. Should allow 3 minutes of heating time for rectifiers before application of high voltage.
RY-1—Overload relay. D.c. relay with solenoid requiring 0.1 to 0.3 amp. Current actually circulating through winding is adjustable by R14. Contact points must be capable of handling about 1 ampere inductive load.
RY-2—High-voltage relay, 120-volt, a.c. solenoid. Points must be capable of handling 10 amp inductive load.
L13—10-henry filter choke, 100 ma.
L14—12-henry filter choke, 300 ma.

Coil Table

L1—12 turns No. 16 enameled solid wire spaced for winding length of 1¼-inch on 1⅛-inch form.
L2—2.5-mh r.f. choke, 125 ma.
L3—9 turns No. 16 enameled solid wire spaced for winding length of 1 inch on 1⅛-inch form. Tap at fifth turn down from plate end of coil.
L4—2.5-mh r.f. choke, 125 ma.
L5—225-μh r.f. choke, 800 ma (National Co.'s R-175).
L6—5 turns ¼-inch copper tubing spaced to occupy length of 2½ inches. Inner diameter of coil is 2 inches.
L7—One-turn coupling coil, ⅛ inch copper tubing. Inner diameter of coil is 2 inches. Space about 1½ inch from L6.
L8 & L9—5½ turns ⅛-inch copper tubing spaced to occupy winding length of 1½ inch. Inner diameter of coil is 1⅛ inch.
L10 & L11—5 Turns of ⅛-inch copper tubing spaced to occupy winding length of 1¼ inch. Inner diameter of coil is 1¾ inch.
L12—Hairpin pickup loop for resonating lamp. Form of No. 16 solid wire about 2 inches long. Space between leads connecting L7 and L8 to their respective output jacks. Actual spacing must be determined by experiment.

—end—

"WRISTWATCH" RADIO COMES TO LIFE



"Dick Tracy" wristwatch radio is smaller than a pack of cigarettes, uses transistors instead of tubes. Built in their spare time by two Western Electric engineers as a gift for Chester Gould, creator of the comic-strip detective, the 1½ x 2 x ¾-inch receiver has an r.f. amplifier, regenerative detector, two transformer-coupled a.f. stages. Only components not in the wristfitting plastic case are the 1-inch lapel speaker, hearing-aid type B battery, and antenna wire (worn under the coat). Tiny knobs control tuning and volume.

This little wristwatch radio is, of course, an experiment, and is not likely to be manufactured in the near future. It is important because it shows what transistors may be able to do at a not-too-distant day.

BRASSPOUNDING BUG BITES BEAUTY

A velvet "fist" on the 80-meter band. One of the youngest and prettiest newcomers to ham radio, 12-year-old Carole Millett of St. Cloud, Minnesota, signs WØIKJ on 3744 kc, doesn't let brass pounding interfere with music and stamp collecting. Carole was trained by dad Beryl Millett, WØRIL.

Modern electronic communications inspire

UNIQUE METHODS IN A TV NEWS PROGRAM

"Today's" communications center. Clocks show time at overseas news points.

By ERIC LESLIE

THE NBC TV news program "Today" calls the scene of its broadcasts a communications center, not a studio. Tape recorders, teletypes, and facsimile (wirephoto) machines are as important to the program as Garroway himself. No small part of the program comes from the outside while the show is actually in progress. While news from the United States is being received on one teletype machine, European news may be coming in from Reuters on another. Two tape recorders pick up voice broadcasts from other cities and hold them for insertion in the program at the proper times. Important items may be rebroadcast immediately. TV pickups from outside points, either live or kinescope, may form part of the programs. And the ordinary Bell telephone plays an important part in getting the news.

All these devices, plus the unusually early program time, have helped "Today" put across an occasional news beat, and keep a little ahead of other TV programs on at least part of the news.

When you hear the program depends on where you live. For Garroway and his staff it runs from 7 to 10 am. Viewers in the Eastern Time Zone see the first two hours. Those on Central Standard Time hear the last two hours, though for both groups the program runs from 7 to 9 on the clock.

The "communications center" itself is as unconventional as the broadcast time. The show takes place in a large area of the RCA Exhibition Hall in New York City, in full view of the passers-by—who may sometimes find themselves on the program when a cameraman occasionally turns his instrument on them.

An ordinary day on the air starts with Garroway reading the newspaper headlines while the camera—and the viewers—also scan them. Then outside reporters may come in—occasionally by TV from other American cities, sometimes by voice only from overseas. A brief commercial and quickie weather report may follow. Then the TV camera scans the teletype strip, reading the news that has just been summarized orally. While this is going on, the audio end is kept busy with recorded music—often the first playing of a new hit tune.

The main weather forecast is an important part of "Today's" program. A little after 10 minutes past the hour, Garroway phones the Weather Bureau in Washington, and listens (with the TV audience) to the full daily forecast, marking up a large weather map with the data received by phone.

Besides the official weather broadcast, shorter ones dot the hour, with readings of the long weather board seen at right center of the photo, which shows the temperatures of all large United States cities. Another large board carries baseball scores, and a third is used for newspaper clips. A special device, called a Vu-graph, consists of a screen on which sketches, graphs or maps may be drawn and televised. Extensive changes, additions, or notes to the main drawing can be made on transparent plastic overlays before or during the program and dropped into place instantly.

Televiewers hear the news at least four times during each hour's broadcast. Between newscasts there may be movie shorts (at one time the viewer was taken on a tour of United States cities, at the rate of one per day), more new records, and the day's special feature, which may be anything up to an interview with a trio of shapely girl lifeguards in bathing suits.

While Garroway and one or two others do practically all the work before the camera, there may be as many as a dozen people on the set during the broadcast. Two girl secretaries are continuously busy receiving news reports, checking with outside sources, posting latest news and temperatures on the boards, and otherwise keeping the program up to the minute. Technicians and operators man the teletypes, tape recorders, and facsimile equipment. Cameramen, directors, and others not directly on the set bring the number of active participants to over 30. And when engineers, writers, advertising salesmen, and all other full-time workers on the program are counted in, the number runs up to 105.

At five minutes before the half hour and the hour, any one of the 38 network stations handling the show may cut in with five minutes of local news or other features. Meanwhile the program goes on at those stations which do not take advantage of the 5-minute breaks.

The one-hour show is repeated three times, with late news items added and with variations and new records for those who may sit through a second viewing. At 10, Eastern Time, the cast and crew can relax for breakfast, presumably glowing with satisfaction at being participants in one of TV's most original and most valuable programs.

—end—

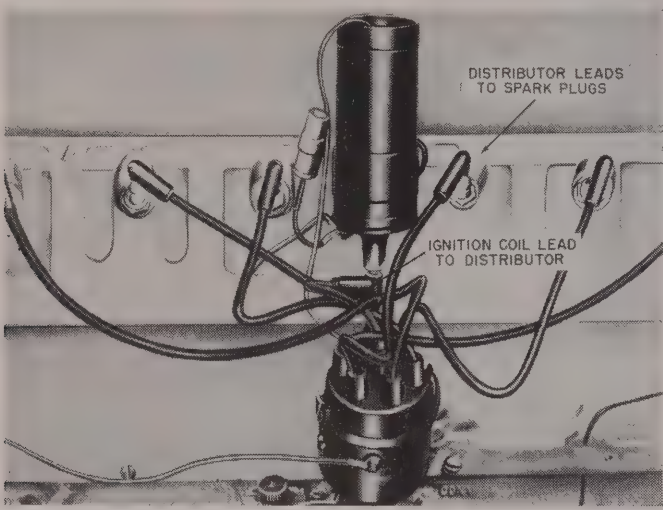
A down-to-earth discussion of mobile interference with lots of practical remedies

MOBILE

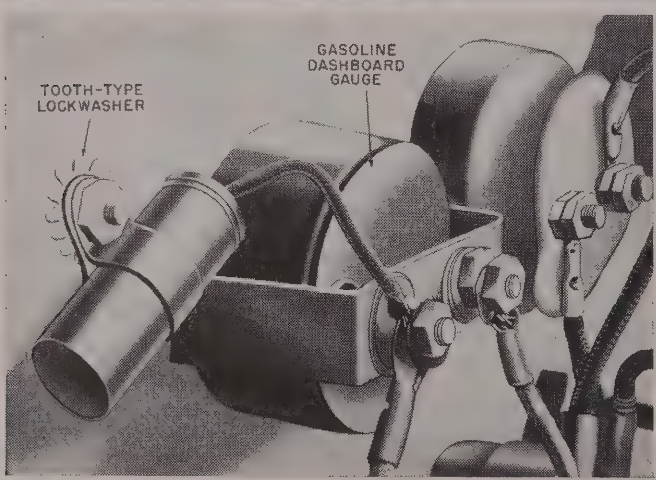
By CAPTAIN WILLIAM H. MINOR, USAF

THE radio service technician or radio operator who has just installed communications equipment in a mobile unit may find he has a number of headaches ahead of him in the form of electrical interference. He must usually work out his difficulties himself. There is little reference material available on the subject of mobile radio interference, and the average auto mechanic is neither interested in nor trained for many of the electrical problems the radio man or communications engineer may bring him. (His interest does not go beyond seeing that the electrical system keeps the car running smoothly and the battery properly charged.)

Listening to interference in the receiver is the best way to identify the source. Each type is characterized by a sound all its own. Avoid hasty conclusions, though, for some can be confusing.



The distributor, coil, and spark plugs cause an easily recognized type of interference. Shielding and suppressors minimize the noise.



Electrically operated gauges are often a source of interference. Bypass hot lead with capacitor grounded as shown in photo.

Ignition Noises

The most common source of ignition interference is the high-voltage discharge that takes place every time a spark plug fires. Each spark generates a series of damped r.f. waves with very strong harmonics. The interference is not too bad in the broadcast band, but gets worse as the frequency increases. It is most severe at about 30 mc.

Spark interference is easy to recognize. With the engine idling each spark discharge is heard as a "pop" in the receiver. As the engine accelerates, the "pops" blend into a continuous rasping noise that varies with the engine speed.

There are other direct and indirect causes of ignition noises. Dirty plugs, bad ignition cables, pitted points, and poor suppressors would be direct causes. Trouble in the voltage regulator, loose electrical wiring, or a bad distributor capacitor could be indirect causes.

When ignition interference is encountered, remove each plug and inspect the ceramic for even the smallest cracks. Cracked plugs should be replaced without question. Clean the body of the plug with a cloth dampened in gasoline or other solvent. The business end of the plug should be cleaned with a blast of ceramic grit and air and the gap should be reset.

The gap is quite important. Car and plug manufacturers specify the correct gap for each car and plug type, with and without a radio installation. Check with a good mechanic if there is any doubt as to the correct gap. Measure gaps with a round not flat, gauge.

Be careful in pulling and installing spark plugs. Use the right tools to avoid cracking the ceramic. Use good

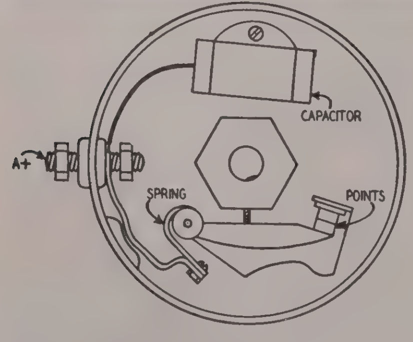


Fig. 1—The distributor breaker box. Opening and closing of points causes transient oscillations which generate noise over a wide range of frequencies.

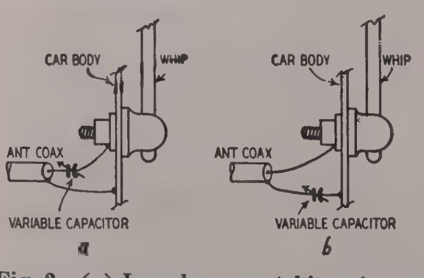


Fig. 2—(a) Impedance-matching circuit in a mobile antenna installation. The capacitor should be completely shielded to reduce pickup of ignition or other noises. (b) Another method of impedance matching used in some cases but not recommended since coax shield is floating.

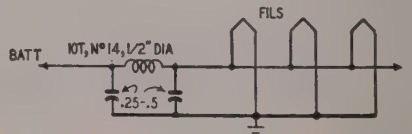


Fig. 3—Heater-line ignition-noise filter of a type employed successfully in most types of commercial automobile radios.

INTERFERENCE

gaskets. Do not tighten the plugs too much or leave them too loose. See that the top terminal nut is tight.

Next check the distributor (Fig. 1). Remove the cap and clean it with gasoline. Inspect it for cracks. This particular part seldom needs replacement, but you should not overlook any possibility. Inspect the distributor points for burning and pitting. (These may be pried apart with a screwdriver. The spring tension is heavy.)

It is good practice to replace distributor points every 10,000 miles, though this is not a hard-and-fast rule. When points are changed it is always good insurance to change capacitors too.

If there is any reason to remove the whole distributor, the firing must be timed when it is replaced. This should be done by a mechanic with adequate facilities.

Inspect the ignition harness. The heavy cable should be covered with good live insulation, free from brittleness and cracks. The metal clips at the ends should be clean and should bite through the insulation into the wire. They should fit the plug terminals firmly. Modern high-compression heads require very high firing voltage. Bad ignition harness can cause corona and leakage discharges which show up as noise in the receiver.

If noise persists after these precautions, some form of suppression may be necessary. For the sake of efficient car operation, this should be held to a minimum. First try a single good *carbon* suppressor at the center lead into the distributor. If this does not help, put suppressors on the individual plugs. Use good *carbon* types. Suppressor-type spark plugs are even better.

The indirect causes should be checked. When plugs foul too quickly or points go bad after only a few hundred miles, the trouble may be in either the battery-charging system or the distributor capacitor.

If your battery requires frequent addition of water, check the charging system. A voltage regulator which maintains full charging rate on the ammeter even after long trips can cause pitted points. Check and tighten all leads between the regulator, battery, and generator. If the full charging rate still continues, have the battery checked and the voltage regulator adjusted if necessary.

Antenna-system Noise

You may find that after all fault possibilities in the ignition system have been tried and corrected, the noise—or part of it—persists. There are still several ways in which interference can find its way into the radio. These should be individually checked.

The antenna lead-in is one offender. This lead must be fully shielded between the base of the antenna and the receiver. In some installations a braided-wire connection is made from the shield to the car body at the point where the lead connects to the antenna. This ground lead must be short—not over ¼ inch. The difference between ½ and ¼ inch may mean the difference between bad and good reception. The standard shielded antenna plug at the receiver eliminates pick-up at that end.

Amateur operators who use the same antenna for transmitting and receiving sometimes use a variable capacitor for matching the antenna to the transmitter. Two commonly used methods are shown in Fig. 2-a and 2-b. Both of these can permit interference to creep into the receiver input. The system of Fig. 2-a can be used if the capacitor is mounted in a shielded box. *Method 2-b should not be used.* It is better to use a loading coil in the whip. This may be base, center, or top, but *should not be inside the car in series with the lead-in.*

Other sources

Ignition noises can enter the receiver through the filament circuit. This is particularly true of home-constructed converters and receivers. If this is suspected as a point of entry, add the simple filter shown in Fig. 3. The coil can be about 10 turns of No. 14 wire about ½ inch in diameter. The capacitors can be 0.25 or 0.5 μf. This type filter is common in auto receivers and may be taken from an old unit. Notice, though, that in commercial sets the capacitor is usually a "spark plate."

In some instances it may be found that additional bypass capacitors are necessary. A 0.5-μf capacitor across the ammeter may eliminate some ignition noise. The temperature indicator has long connecting leads to a thermocouple mounted in the motor lead. A 0.5-μf capacitor across the thermocouple will sometimes help. The capacitor should be a type which will not be broken by engine vibration. The type used on the generator is quite satisfactory.

As a last resort bonding may help. This will rarely have to be more than a short braided wire connecting the hood to the car body. *Make it short* and install it where it will not interfere with lifting the hood.

Generator Noises

A third source of interference is the generator. This is easy to identify by its characteristic whining noise in the receiver. If the commutator or brushes are bad, a popping noise can accompany the whine. The interference rises in pitch as the engine speed increases.

Remove the band from the generator and inspect the brushes and commutator for wear, dirt, and pitting. Replace pitted and worn brushes.

A dirty commutator can be cleaned by holding a piece of No. 00 sandpaper against it with a small block of wood. Let the engine idle so the generator turns slowly. *Never use emery cloth to clean the commutator.* Use oil when

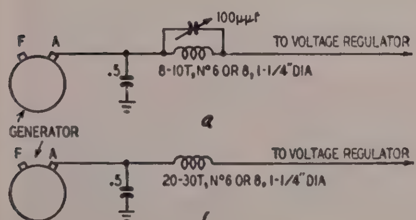
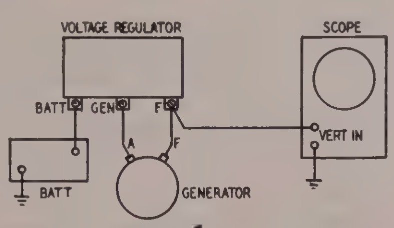


Fig. 4—(a) Tunable generator-noise filter for mobile communications equipment. (b) A simpler form of generator filter, tuned by trimming down the choke coil.



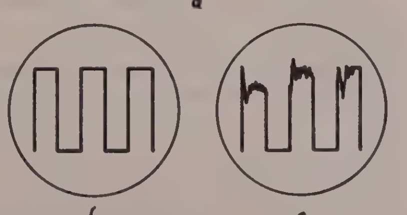


Fig. 5—(a) Hookup for checking voltage-regulator operation with an oscilloscope. (b) Normal voltage-regulator output. (c) Irregularities mean bad contacts.

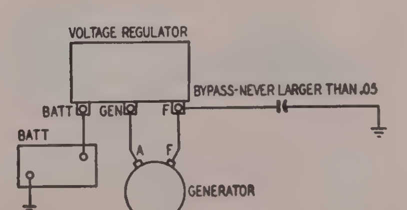


Fig. 6—Bypass capacitor from generator "F" terminal to ground may reduce voltage-regulator hash. Capacitor should be metal-cased and limited to value shown.

necessary but avoid over-oiling, for this can gum up the commutator.

A deeply cut or pitted commutator must be turned down on a lathe. This should be done by an experienced mechanic.

The generator should have a bypass capacitor from the "A" pole to ground. Its value is usually around 0.5 µf.

The whining noise noticed around 14 or 28 mc may be eliminated entirely by the use of the filter shown in Fig. 4-a or 4-b. In 4-a the coil is 8 or 10 turns of No. 6 or No. 8 wire wound on a short piece of broomstick and shunted with a 100-µµf trimmer. This can be tuned for minimum whine in the receiver while the engine is turning at cruising speed.

Since the filter is not critical, the circuit shown in Fig. 4-b can be used. This coil is 20 to 30 turns of No. 6 or No. 8 wire on a piece of broomstick. Exact specifications cannot be given, for they will vary with installations. Start with 30 turns and remove a turn or two at a time until the whine disappears.

Generator noise can also be caused by wiring or voltage-regulator trouble. First inspect the generator after the car has been run for a short time. If the generator runs hot, look for loose connections between the generator and voltage regulator. If these are O.K. the regulator should be checked and adjusted.

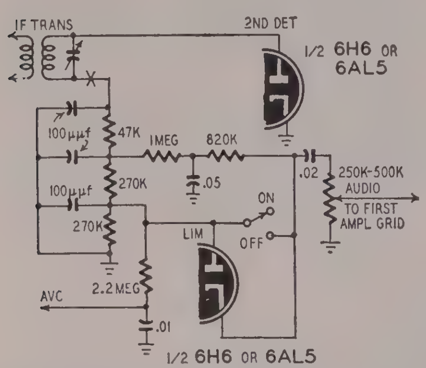


Fig. 7—Noise clipper circuit adaptable to most mobile communications receivers.

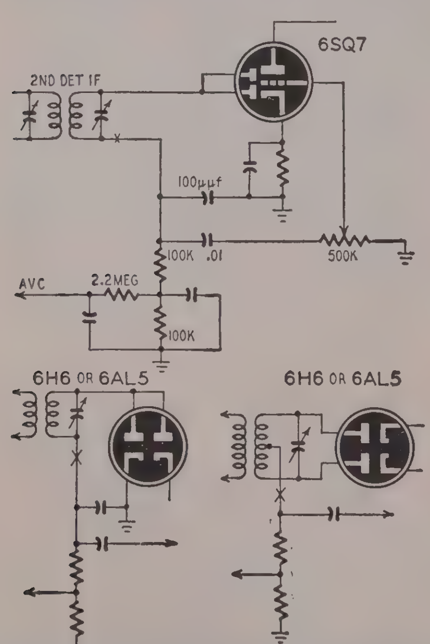


Fig. 8—Methods of connecting the noise clipper to three types of 2nd detector.

Voltage-regulator noises

The voltage regulator can be an indirect cause of several types of interference. It can also be a *direct cause*, for there are vibrating relays in the unit. One of these operates when the battery is at or near full charge. During this time it may vibrate as often as 200 times per second. Corroded, burned, or bouncing relay points can cause severe interference.

This source can be identified by an intermittent hissing noise in the receiver. Often the ammeter pointer bounces in step with the noise. A good way of testing for this noise is to connect an oscilloscope as shown in Fig. 5-a. The trace should be a good square-wave (Fig. 5-b). An irregular trace (Fig. 5-c) would indicate bounce or arcing and would be accompanied by interference.

The voltage regulator is a touchy instrument, and the cure may present something of a problem. If the relay contacts are badly burned, the best bet is to replace the regulator. Slightly-pitted contacts can be cleaned with a good point file and wiped with a lint-less cloth. The gap and spring tension must be adjusted for correct voltage output (consult the manufacturer of the particular regulator). Also clean the make-and-break.

If interference persists a bypass capacitor can be connected between the generator "F" lead and ground. (Fig. 6). Under no circumstances use more than .05-µf. A .005-µf unit will probably be sufficient.

A word of caution. This type of interference can be completely eliminated by misadjusting the voltage-regulator relay. If this is done, the regulator will not operate properly and the battery and distributor points may be ruined. The oscilloscope test would show no square wave output from the regulator. *Avoid this misadjustment.*

Wheel and tire noise

Occasionally noise is introduced through the car wheels. This can be caused by poor bonding between the wheels and axles. A good way to distinguish this from electrical-system interference is to allow the car to coast at high speed with the engine off. If the interference continues, the cause is probably in the wheels.

Practically all wheel noise can be eliminated by installing bonding springs between the wheels and the axles. These are standard items with most parts suppliers.

Certain types of tires cause a singing or whining interference which is most noticeable on the black-top or macadam roads. The same test given above for wheel noise can be made. Driving with two wheels off the paved surface of the road will lessen the noise. A powder is available at most radio supply houses which can be inserted in the tire tubes. This will eliminate tire noises.

Static-discharge noises

Static discharge occurs when the car is moving or during thunderstorm conditions. It is a steady crackling sound almost identical to ignition noise when caused only by car motion. It can be distinguished from ignition noise because its intensity depends upon *car speed* while ignition noise depends on *engine speed.*

A metal brush with many small sharp points can be attached to the car body. The fine points discharge the static into the air before it can build up to a severe noise level.

An intermittent hissing noise starting at high intensity and diminishing quickly is usually whip discharge. It is most frequently noticed during thunderstorms, but can occur at any time the car is in motion. The static built up in the car may discharge through the sharp tip of the antenna rod. This can be reduced by attaching a metal ball to the antenna tip. The brush mentioned above will also help.

Other noise sources

Any other electrical device insulated from the body of the vehicle may be a source of interference. This applies to panel instruments (ignition switch, ammeter, gasoline gauge, light switches, heater and defroster controls, electric clocks, cigar lighters, etc.), interior lights with door-operated switches, ventilating fans, and especially blinker-type warning signals. Wherever possible the ground side of each device should be bonded to the body of the car, and the hot terminal bypassed with a 0.5-µf *shielded* capacitor. All mechanical control shafts entering the body through shock- or moisture-proof mountings should be grounded.

Receiver modifications

A noise-clipper circuit may be installed in the receiver to limit extra-strong peaks and reduce interference orginating outside the vehicle. A very effective and simple clipper (from the Hammarlund HQ-129X) is shown in Fig. 7. Connections to the receiver will depend on the second detector circuit. Three methods are shown in Fig. 8 (See "Cut QRM With Noise Limiters," by Alvin B. Kaufman, in the June, 1951, RADIO-ELECTRONICS.—*Editor.*) The 6H6 has been found to work slightly better than the 6AL5, but the advantages of each type should be considered in adding the circuit. Make every effort to eliminate locally-generated noise *at the source.* Use the clipper to cut down externally-generated noises. A Greyhound bus, for example, can be heard in the receiver for nearly ¾ of a mile. Passenger cars can be heard at 300 to 1,000 feet. A clipper almost entirely eliminates this source of trouble and for that reason is an essential part of any mobile short-wave AM receiver.

—end—

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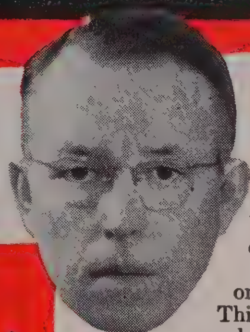

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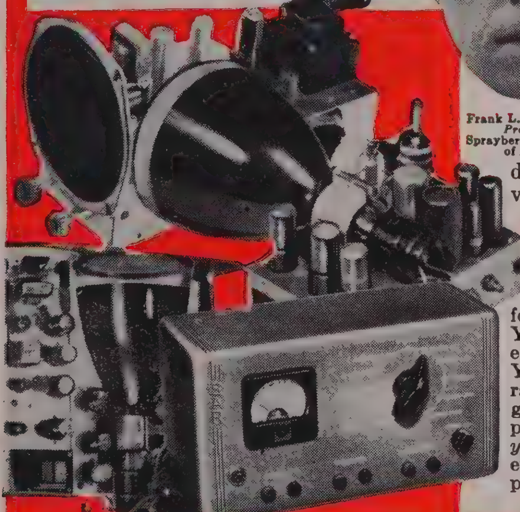

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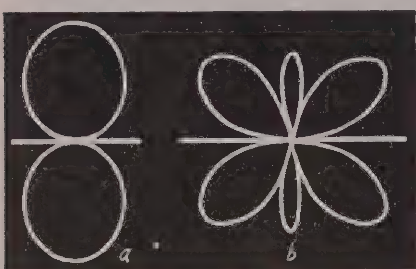


Fig. 1—Horizontal pattern of dipole at fundamental and at third harmonic.

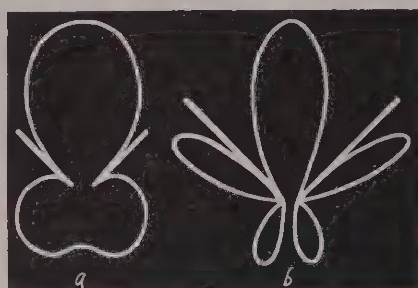


Fig. 2—Radiation pattern of the Fig. 1 dipole with the ends tilted forward.

Fig. 3—Evolution of conical antenna.

By DOUGLAS H. CARPENTER*

CERTAIN basic problems concerned with tuner, preamplifier, and antenna equipment have always plagued the TV design engineer. Most of these problems have been created by the inconvenient division of the spectrum into high and low v.h.f. channels. Television receiver front ends have to cover a frequency ratio of almost 4—1. This greatly complicates the design of continuously-tuned types, and increases the cost of efficient tuning mechanisms. Signal boosters of course must also be designed to cover both high and low channels, and losses in optimum performance due to switching have been minimized, but never completely eliminated.

The antenna engineer faces the same basic problems as those faced by the circuit design engineer, but with the additional aggravation of limited working constants. Antenna research has been accelerated by TV, but, until recently, has failed to produce a markedly improved type. Most of the antennas dotting the country's roof tops are simple variations of basic designs described for years in engineering manuals. Installation requirements have generally created a demand for two basic types: broadband systems for multichannel areas, and selective high-gain antennas for single-channel fringe-area reception. For fringe reception, the Yagi has become well entrenched as the single-channel champion. Where several channels must be received, it is generally conceded that the conical does an outstanding job. For readers not familiar with antenna theory, it might be well to review the principles of that antenna.

Conical antenna operation

A simple half-wave dipole covers a limited frequency range, and has a bidirectional or figure-8 pattern with the planes of maximum radiation at right angles to the directions in which the antenna points. To increase the bandwidth of the simple dipole, it is necessary only to increase its tubular diameter. To further increase bandwidth, an understanding of the familiar "tilt" employed in the conical receiving element is necessary. Fig. 1-a shows the horizontal pattern of a simple half-wave dipole at its design frequency, and Fig. 1-b shows the same dipole at three times this frequency. Fig. 2-a illustrates a receiving element of the same physical dimensions and the same base frequency with the ends tilted. Fig. 2-b indicates horizontal directivity at three times this frequency. The major lobes are superimposed, resulting in increased gain and a sharp horizontal pattern. The 3—1 frequency ratio is roughly that between the high and low v.h.f. television channels. The tilting effect is the basic principle controlling the extended bandwidth of the so-called conical-type antenna. This simple arrangement would work at two preselected frequencies in the television spectrum, but the center impedance of the system would vary radically at frequencies not far from the design and third-harmonic points.

To extend the frequency response around the design points we can electrically simulate a "filled-in" triangular area or solid sheet. This is accomplished in the case of the conical by angularly locating three separate receiving elements on either side of

*Engineering Division, La Pointe-Plascomold Corp., Rockville, Conn.

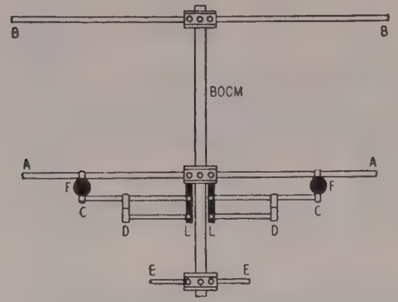


Fig. 4—Details of the Q-Tee antenna.

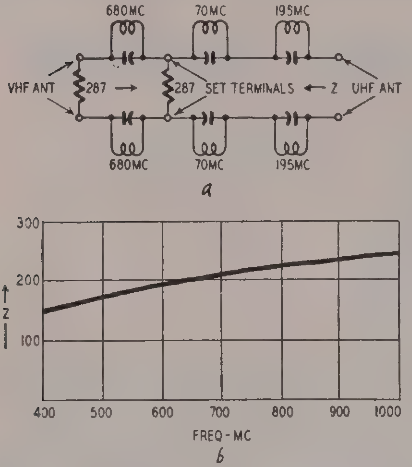
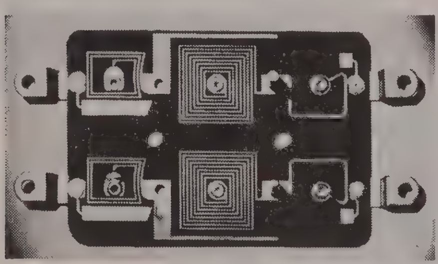


Fig. 5—Schematic and impedance characteristics of the band-isolation filter.



Courtesy Vee-D-X (Lic. A. A. K.)

Fig. 6—The printed-circuit filter which separates u.h.f. and v.h.f. sections.

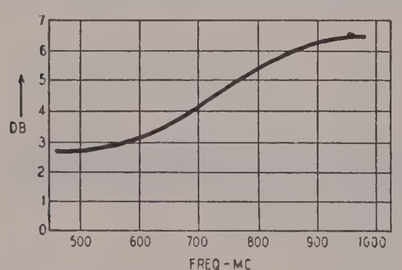


Fig. 7—Ultra Q-Tee gain *vs* frequency.

the feed junctions so that their fields intercouple, resulting in a lowered Q of the radiator section. This is illustrated in Fig. 3. It will be noted in Figs. 2-a and 2-b that the horizontal pattern of the conical is not ideal throughout the entire v.h.f. spectrum. Tilting the elements displaces the natural directivity response of the dipole, and broadens the pattern on channels 2–6. What actually happens is that the forward response is made worse because of angular separation of the major natural lobe. This type of antenna is therefore susceptible to increased noise pickup. Signal-to-noise ratio as seen by the front end of the receiving system is directly proportional to the power gain of the antenna and inversely proportional to the width of the horizontal pattern at the frequency under consideration.

Antenna design engineers have thus far found no substitute for natural resonance and sharp horizontal directivity for optimum results. A new approach to the old problem of extending bandwidth while maintaining sharp horizontal directivity has been accomplished by a method quite different from that of the conical types. Fig. 4 is a drawing of the "Q-Tee" antenna. It consists of separate radiator and parasitic elements, coupled with isolation networks which permit independent operation of these separate sections with a common transmission line. B is a half-wave reflector cut for channel 2. Consequently it is effective throughout channels 2–6. Radiator A is also half-wave, with center resonance at 63 mc (channel 3.) Filters F-F are resonant at 195 mc and isolate radiator A from full-wave receiving element C which is cut for the center of the high channels. The T-matching transformer D is tapped into the full-wave receiving element C at a point that converts the impedance characteristic to the transmission line value. Director E is effective over channels 7–13 and has no function on channels 2–6.

If we first consider the operation on channels 2–6 the entire radiator section and reflector B are operative. Tracing from transmission-line feed points L-L, sections D and C "look" like a dual-section T-matching transformer, and match the transmission line impedance to the proper point on the low channel radiator A. Reflector B, as mentioned, controls the horizontal directivity response and center impedance of the radiator section in the low-channel v.h.f. range. Parallel filters F-F are practical short circuits, as they are operating at frequencies remote from resonance. The slight residual series impedance of the filters is utilized in the total match back to the line feed points. Sharp horizontal directivity is obtained by the reflector action, and broad bandwidth by mutual coupling of the elements comprising the total radiator section.

On the high v.h.f. television channels, director E, matching transformer D, full-wave radiator C, and filters F-F control operation. At these frequencies the center impedance of radiator C is dependent upon the spacing of director E. Transformer D matches the line to the proper points of radiator C which is now effectively isolated from the low-channel radiator A by the parallel resonant action of filters F-F. With the u.h.f. spectrum about to go into use, emphasis has been placed on special antennas for higher frequencies. Again, the types used at v.h.f.—if made smaller—become practical at u.h.f. Antennas using tilted or V elements can cover a certain broad band of frequencies by taking advantage of the method of Fig. 2-b. Such a system generally restricts the response to a frequency ratio of 3—1.

V.h.f.-u.h.f. antenna

Spreading the frequency acceptance throughout the range of 54–890 mc is possible (at least at this writing) only by selective filtering as employed in the Ultra "Q-Tee" antenna system. Basically, the Ultra "Q-Tee" is an extension of the v.h.f. "Q-Tee" system employing selective separation through the use of a special 6-section printed-circuit filter assembly. Fig. 5 is a schematic of the filter circuit indicating connecting points of the v.h.f. "Q-Tee," transmission line, and u.h.f. antenna section. The problem of simultaneous v.h.f-u.h.f. operation is solved by isolating the separate receiving elements and delivering all signal voltages to a common transmission line. Fig. 5-a indicates how this is done. Throughout the v.h.f. range, the "Q-Tee" operates as an independent section as described. Shunt loading of the u.h.f. section is eliminated by the parallel-resonant series filters labeled 70 and 195 mc. Filters labeled 680 mc are short circuits to the passage of v.h.f. signals, being designed for the u.h.f. range. Looking toward the load (transmission line) from the u.h.f. antenna, the series filters 70 and 195 mc are short circuits, and filters labeled 680 mc are high impedances isolating the v.h.f. section and permitting independent operation of the u.h.f. antenna. Fig. 5-b shows the average impedance characteristic of the filter throughout the u.h.f. range when properly terminated in average 300-ohm line loads. This information was compiled using a General Radio admittance meter and adjustable "baluns" in the u.h.f. range.

The importance of proper termination at u.h.f. cannot be overemphasized. A slight standing-wave ratio on the transmission line at v.h.f. will not cause a serious amount of signal loss. The fixed constants of the receiver input circuit and antenna termination are much easier to control. Constants that are purely resistive in the lower frequency range develop reactive components in the u.h.f. spectrum. Design of antenna termination, transmission lines, and the eventual receiving system load require much more exacting measurement.

A typical example of the care that must be exercised is a bend in common 300-ohm line at these frequencies. If the bend or impedance variation of the line is an appreciable fraction of a wavelength, a high standing-wave ratio will result. Only a small physical length of line need be altered at u.h.f. to create such a condition.

At this writing, there is no ideal line available for use at u.h.f. Although receiver inputs have been standardized at the 300-ohm figure, present-day lines leave a lot to be desired. Standard ribbon line has an average loss factor of

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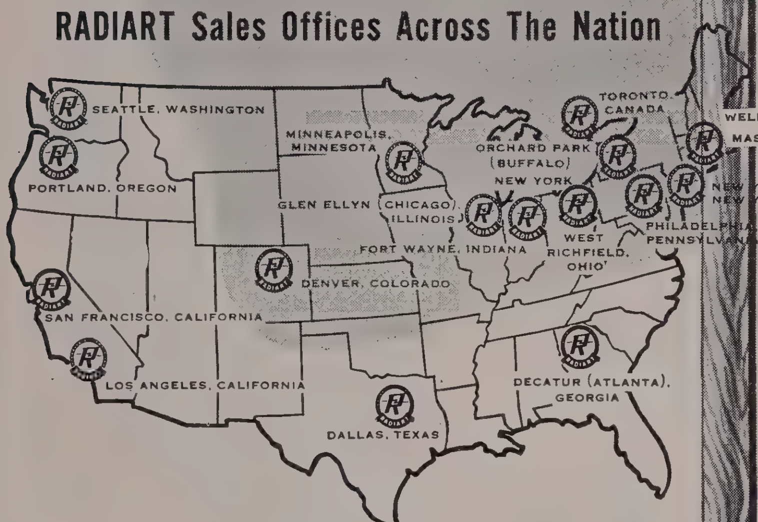

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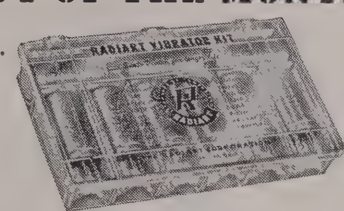

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4 db per 100 feet when dry, and between 20 and 30 db when damp. Good grades of coaxial line are less susceptible to moisture absorption, but have a fixed loss of approximately 9 db per 100 feet at the center of the u.h.f. band.

Fig. 6 is a photograph of the printed-circuit filter used in the Ultra "Q-Tee." Printed-circuit technique adapts itself nicely to use in the u.h.f. range, where exact duplication of components is mandatory. More familiar constants of L and C would work as well as the printed-circuit types, but control of tolerances to ½ of 1% would make such an arrangement expensive and impractical from a cost standpoint. Another advantage of the printed-circuit filter over conventional types is the "loading" of the parallel circuits by the composition of the dielectric material. Controlled insertion loss (effective frequency isolation through resonance), and consequently the bandwidth, can be easily controlled by selecting the proper base material. For this specific application phenolic sheet 1/16-inch thick was used. The ratio of L to C must be chosen to provide a definite bandwidth when phenolic material is used as the dielectric.

Another application for the 6-section filter could be isolation of separate antennas for v.h.f. and u.h.f. For this job, it would be installed at the receiver location. Such an arrangement would eliminate a transfer switch for antenna selection.

As will be seen from the photo at the head of this article, the receiving element of the u.h.f. section of the Ultra "Q-Tee," is of the "tilted" or V type. At u.h.f. such design is practical, as we are dealing with one continuous range (470-890 mc). The angle of the V is chosen to superimpose the major lobes exactly at 1,000 mc. The length of the elements comprising the V is cut slightly less than the v.h.f. director. This is to take advantage of the reflector action of this element in the u.h.f. range. At the low end of the u.h.f. range, the V is one-half wavelength on a side and has a fairly high center impedance if considered independently. It is matched through the filter sections. At the one-and-one-half wavelength points, the V has a lower center impedance, but this is compensated for, as far as the transmission line is concerned, by the rising impedance characteristic of the filter itself. (Fig. 5-b). At the two-wavelength point (high end) we have the same impedance-matching problem as at the low-frequency end.

The power gain and directivity of the V-type antenna increases as the number of wavelengths on a leg become greater. The chart of Fig. 7 indicates the gain of the Ultra "Q-Tee" over the entire u.h.f. spectrum as compared to a tuned folded dipole.

Horizontal gain will increase on the average of 2.75 db if two antennas are stacked. This is of course true for both the v.h.f. and u.h.f. sections.

With the impending use of the u.h.f. spectrum, it is felt that the service technician should find wide application for this versatile antenna system.

—end—

Cathode Follower Applications Range From Hi-Fi Audio Circuits To V.H.F.

By I. QUEEN

A CATHODE follower is useful in many ways. Most important, its input impedance is higher than the conventional grounded-cathode circuit, while its output impedance is much lower. It is equivalent to a step-down transformer with the advantage that it is effective at *high* as well as low frequencies. In addition, it is a power amplifier. Because of its impedance characteristics, the cathode follower is ideal for coupling high-gain amplifiers. As a power amplifier, the follower may also be used in an audio output stage.

In a cathode follower the plate is grounded for the signal. This is shown in Fig. 1 where C grounds the plate

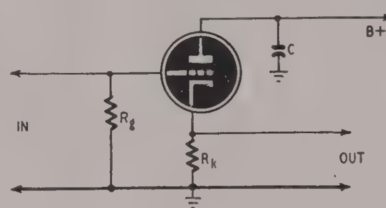

Fig. 1—Basic cathode-follower circuit.

for a.c. The plate may be connected to the B supply directly or through a dropping resistor.

This circuit has 100% negative feedback. The grid and plate circuits return to the cathode through the common load R_k. If the grid goes more positive, more plate current flows through R_k and drives the cathode more positive. Thus part of the original signal is cancelled out. This feedback reduces distortion and permits wider-band operation. Since part of the signal is opposed by the tube output, we can apply larger signals without overload.

The output voltage opposes the input but can never equal it, so the cathode follower is useless as a voltage amplifier. However, there is considerable current flowing through the cathode load and we *do* have power amplification.

Miller effect is absent in the cathode follower. This effect is the apparent multiplication of input capacitance. It is present only in tubes which show voltage gain. In the follower, the input capacitance is relatively low, therefore the input impedance remains high.

When a tube is used as a cathode follower, strange things happen to its plate resistance (R_p) and amplification factor (μ). The values given in tube manuals apply only to conventional grounded-cathode circuits. For a follower, the apparent tube resistance is reduced to $R_p/\mu+1$. This is nearly $1/G_m$, where G_m is the mutual conductance given in mhos. The apparent amplification factor becomes $\mu/\mu+1$ which is less than unity. This confirms what we said previously about voltage gain. As an example, consider the 6J5 triode. The manual shows: $R_p = 7{,}700$ ohms, $\mu = 20$, $G_m = .0026$ (mhos). As a cathode follower, the *apparent* R_p is only 7,700/21 or 366 ohms. The *apparent* μ is 20/21 or 0.95.

The equivalent circuit of a cathode follower is drawn in Fig. 2. The apparent plate resistance shunts the cathode resistor (since both are connected between cathode and ground). The output impedance is less than either R_k or $R_p/\mu+1$. As shown before, it is always less than $1/G_m$. The next stage (or any other reasonably high-impedance load) will have negligible loading effect on the follower.

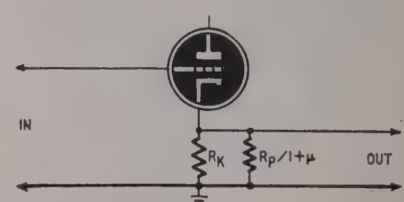

Fig. 2—Equivalent output impedance.

Fig. 3 is a typical arrangement for coupling and *isolating* high-gain stages. CF1 has a high input impedance so there is negligible loading of the signal source. Its output impedance is low, so AMP1 has practically no effect on the cathode follower. CF2 isolates the amplifiers. Its high input impedance does not load down the previous AMP1. Its output impedance is so low that AMP2 produces no loading effect. Thus a follower effectively *isolates* amplifier stages. The signal is transmitted easily enough but the stray capacitance of one amplifier cannot combine with that of the next.

If the output load in Fig. 3 were a transmission line or other low impedance, a third follower stage would be used between AMP2 and the load. This permits better impedance match over a wide frequency band.

Fig. 4 is a typical follower used to deliver output at audio and ultrasonic frequencies. It is the output stage of the Hewlett-Packard low-frequency standard (type 100A) effective from 100 cycles to 100 kc. A 1-megohm resistor between plate and grid main-

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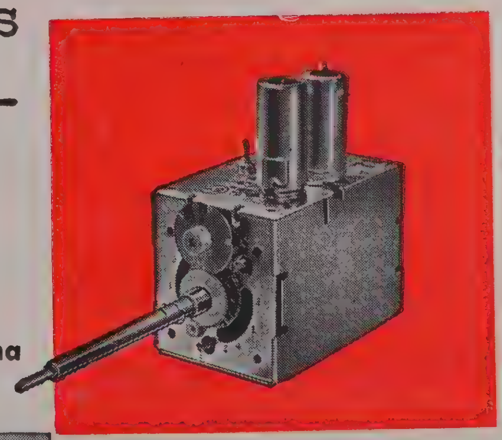

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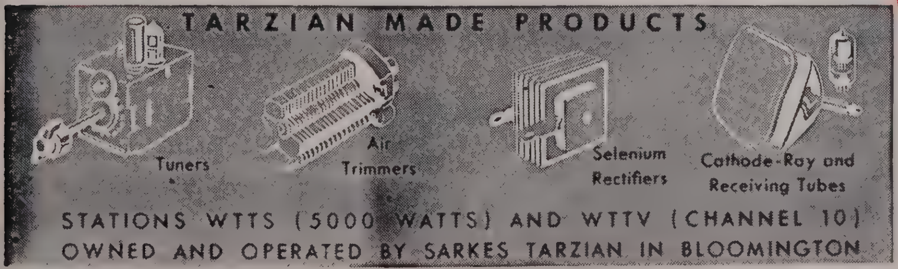

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tains the latter positive by 44 volts. Thus a large cathode resistor (5,600 ohms) may be used for maximum output. The 6AC7 is triode-connected. Due to its high mutual conductance, the apparent R_p is low. The load on this circuit may be as low as 1,000 ohms without distortion and with little reduction in output voltage.

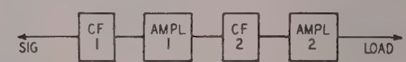

Fig. 3—Cathode followers as isolating stages in high-gain wide-band amplifier.

Fig. 5 is an example of a high-frequency cathode follower. It is the i.f.-v.f. output stage of the RCA WR-59A sweep generator. It delivers 0.1 volt at frequencies up to 30 mc. The 6J6 triodes are parallel-connected. This doubles the effective G_m and results in

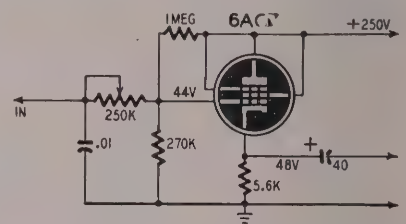

Fig. 4—Schematic of a commercial follower flat from 100 cycles to 100 kc.

still lower *apparent* R_p. Fig. 5 has an output impedance of about 100 ohms. A 100-ohm terminating resistor R is connected across the output cable to eliminate standing waves. The tap at P permits grid bias adjustment.

Although the output impedance of a follower is very low, it is still too high for direct matching to a low-impedance speaker voice coil without using a large number of paralleled tubes.

Fig. 6 shows a cathode-follower audio output stage. The push-pull beam-power tubes are used as triodes. For maximum power output Z_1 should equal

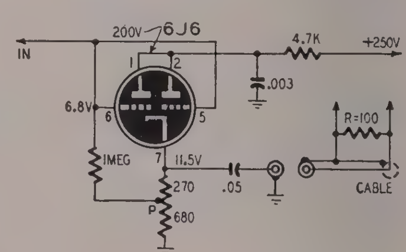

Fig. 5—RCA sweep-generator output stage for frequencies to about 220 mc.

$4 \times R_p/\mu + 1$. For 6L6's this is approximately 1,000 ohms. For maximum *undistorted* output the primary impedance should be about 2000 ohms. With the same input signal, the output power is about $1/\mu$ (where μ is large) as much as in a stage having no feedback. For greater output a peak signal of 150 volts may be fed to each tube in Fig. 6. More than 8 watts output will be available. However, the large signal may require an input transformer, raising the cost and introducing some distortion.

In all the examples shown the tubes are either triodes or pentodes con-

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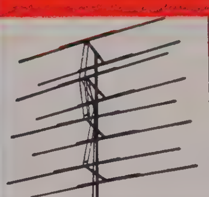
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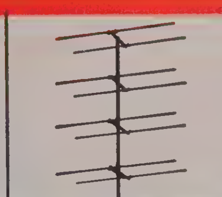
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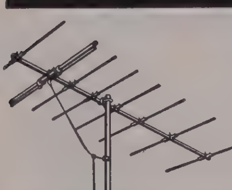
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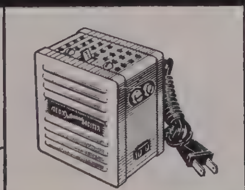
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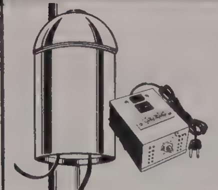
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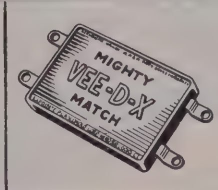

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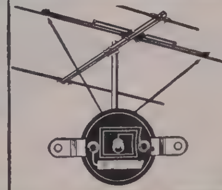
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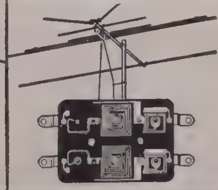
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nected as triodes. It is not practical to use a straight pentode. Since the plate is grounded, this element and the screen grid (which is always grounded through a capacitor) are effectively strapped together.

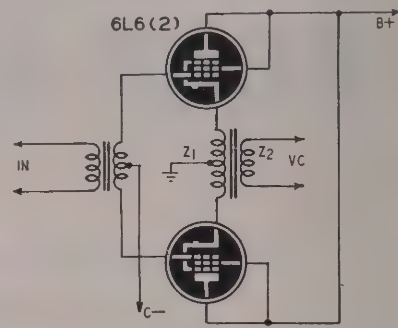

Fig. 6—Push-pull audio power amplifier with cathode-coupled output transformer.

The output from a cathode follower has the same polarity as the input signal. A more positive voltage on the grid increases the plate current and makes the cathode more positive, therefore input and output are always in phase.

The use of cathode followers in audio output circuits may take a new direction in the near future. With the development of high-impedance speaker voice coils, it may be possible to eliminate the output transformer entirely. Balanced voice-coil windings could replace the output-transformer primary in Fig. 6. The *magnetizing effect* of the d.c. cathode currents is cancelled by the fact that in a perfectly balanced stage, equal currents flow in opposite directions from the center tap. The *heating effect* of the d.c. remains, however, and reduces the speaker's power-handling ability. One of the problems still facing speaker designers is how to dissipate the heat without increasing the size of the voice-coil structure or the size of the magnetic gap.

—end—

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4. How To Enter . . . To be eligible for one of the 187 cash prizes, you must send in one completed Official Entry Blank (available at your regular Parts Distributor) together with all the empty Jensen Needle packages you have collected during the period of the contest. All Jensen Needle packages, EXCEPT the Jensen "Symphonette" and Jensen Coin Machine Needles, are acceptable.

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Do not send your entry to your Parts Distributor. You may hold your entry until the last day or send it in as often as you like, but be sure you have a suitable means of identification with each shipment (such as your original Official Entry Blank). REMEMBER: All entries must be postmarked before Midnight, December 31, 1952, to be eligible.

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BATTERY OPERATED THYRATRONS

By I. QUEEN

Thyratron tubes like the 2050 have many applications. Several were discussed in the article by Bukstein in the May issue. These circuits required a voltage source of at least 117 volts, which is above the ionizing potential of the gas tube. Recent inventions have eliminated need for this high-voltage source. Even a few volts from a battery is sufficient. The new circuits use high-voltage pulses to fire the thyratron. The pulses may be fed directly or after rectification. A low-voltage battery is used to generate the pulses.

Fig. 1 is the invention of William M. Webster, Jr., of Princeton, N. J. It re-

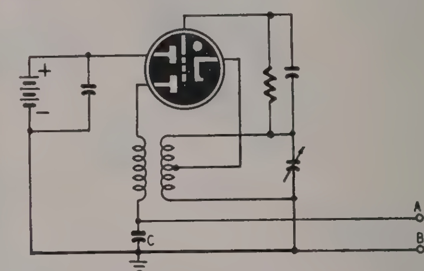

Fig. 1—Simple oscillator circuit ionizes special battery-operated thyratron.

quires a special gas tube. Besides the usual elements, it has an auxiliary anode at the lower part of the tube. The cathode and this auxiliary element are spaced for easy ionization. Once this region contains even a few ions, the main tube discharge follows at once.

Here is how the tube is started: Before it conducts, only a minute current flows between the elements. The cathode, grid, and main anode form a Hartley oscillator hookup. Weak oscillations start and build up. The oscillations are stepped up by a transformer and fed to the auxiliary anode. The high voltage is rectified and C is charged. In a short time the voltage is sufficient to fire the tube. This voltage is available at terminals A-B for external use if desired.

Fig. 2 has been patented by Edward O. Johnson, also of Princeton. It uses

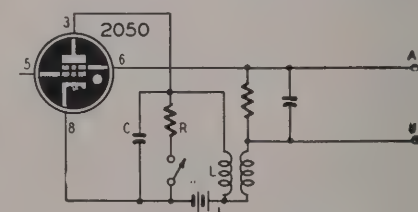

Fig. 2—High-amplitude inductive kick triggers thyratron when switch is opened.

an ordinary type 2050 tube. When the switch is closed, current from the low-voltage battery flows through coil L and resistor R. Opening the switch interrupts the coil current. This abrupt change generates a high-voltage pulse across L. The transformer steps up this voltage and feeds it to the screen (through a resistor). It starts an aux-

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iliary discharge through the tube. The main discharge follows. Current flows between cathode and anode from the battery.

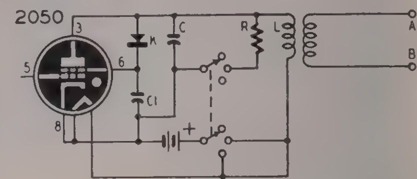

Fig. 3—Another method of triggering a thyratron with a low-voltage battery.

Note that ionization does not require a steady voltage or even a.c. In this case it is just a momentary pulse. Once fired, the tube continues to pass current even if the potential difference is small.

The next circuit (Fig. 3) was patented by both scientists mentioned above. A type 2050 is used here, also. Thyratron action is started by a 2-pole, 3-position switch. It is shown here in the off position. In the second position, it permits battery current through the filament. Current also flows through an R-C-L circuit somewhat like Fig. 2. When the switch is thrown further, it interrupts the coil current. Again a high-voltage pulse is generated. It flows through the rectifier and charges C1. The tube screen potential is so high that the tube fires. Now the main discharge occurs between cathode and anode, even though the battery voltage is low.

These three circuits have no wide practical use yet, but their possibilities are very good—it is only a matter of time. We may expect specially-designed tubes with as good efficiency from batteries as present types on line a.c.

Low power requirements and miniaturization should make circuits of this type particularly valuable for remote-control applications—especially with model planes. The switches might be germanium diodes or transistors, with the sequence controlled by pulse-type signals from a low-powered transmitter.

By a strange coincidence, these patents were applied for on the same day, January 2, 1951, and also were issued on the same day, April 8, 1952.

—end—

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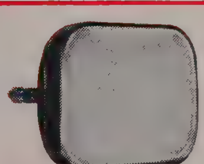

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AUTOMATIC VOLTAGE REGULATION FOR R.F. HIGH-VOLTAGE SUPPLIES

By ALFRED HAAS

R.F. power supplies of the type shown in Fig. 1 are widely used in television, oscilloscopes, radiation counters, and other devices that require very high voltages at currents up to about 1 ma. Compared with line-frequency transformer-rectifiers, they have the advantages of low cost, small size and weight, and safety, but the voltage regulation is generally poor for two reasons:

1. The high d.c. resistance of the rectifier and filter causes large changes in output voltage with changes in load.

2. The oscillator tuning is also affected by changes in load. The filter capacitor (C_F) and the internal capacitance of the rectifier (C_R) are part of the tank circuit. A change in load current becomes effectively a change in tuning capacitance. The oscillator resonance curve (Fig. 2) is generally quite steep, as high-Q tank circuits are used for efficiency and high output. If the oscillator is normally tuned to the peak of the resonance curve, the detuning effect of a change in load will cause a large drop in r.f. voltage and a decrease in the rectified output.

(In unregulated circuits this effect is kept as low as possible by tuning the oscillator to a frequency on the *relatively flat* high side of the resonance curve. The maximum output voltage is reduced, but regulation is improved.)

A recent French invention utilizes the electrostatic attraction between the plates of a capacitor as an automatic voltage regulator. When a capacitor is charged, the positive and negative polarities tend to pull the opposite plates together. In ordinary capacitors the physical barrier of the dielectric,

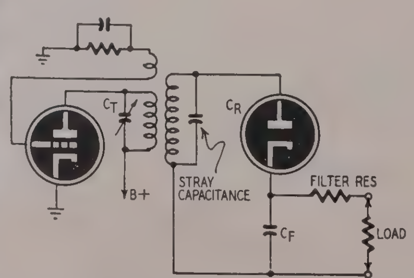


Fig. 1—Basic circuit of most r.f.-oscillator-type high-voltage power supplies.

or in air capacitors the rigid mounting, prevents any actual movement of the plates. The attracting force is directly proportional to the voltage.

If one of the capacitor plates is flexible, an increase in applied voltage will bend it toward the fixed plate and increase the capacitance. A reduction in voltage will reduce the attraction and

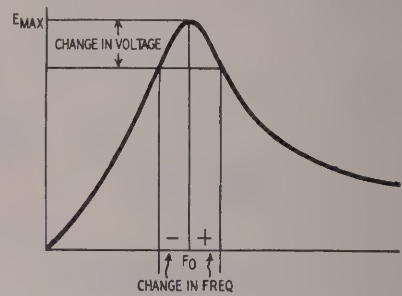


Fig. 2—H.v.-oscillator output curve.

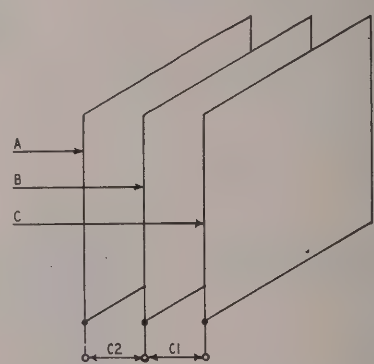


Fig. 3—The automatic voltage-regulating capacitor described in the text.

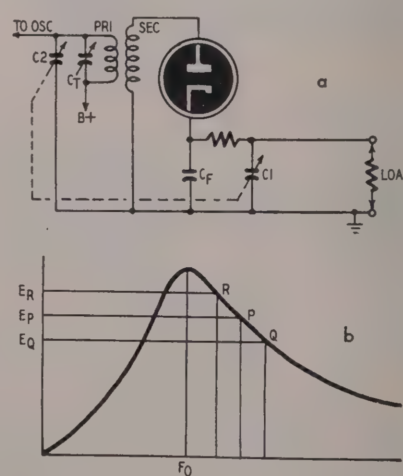
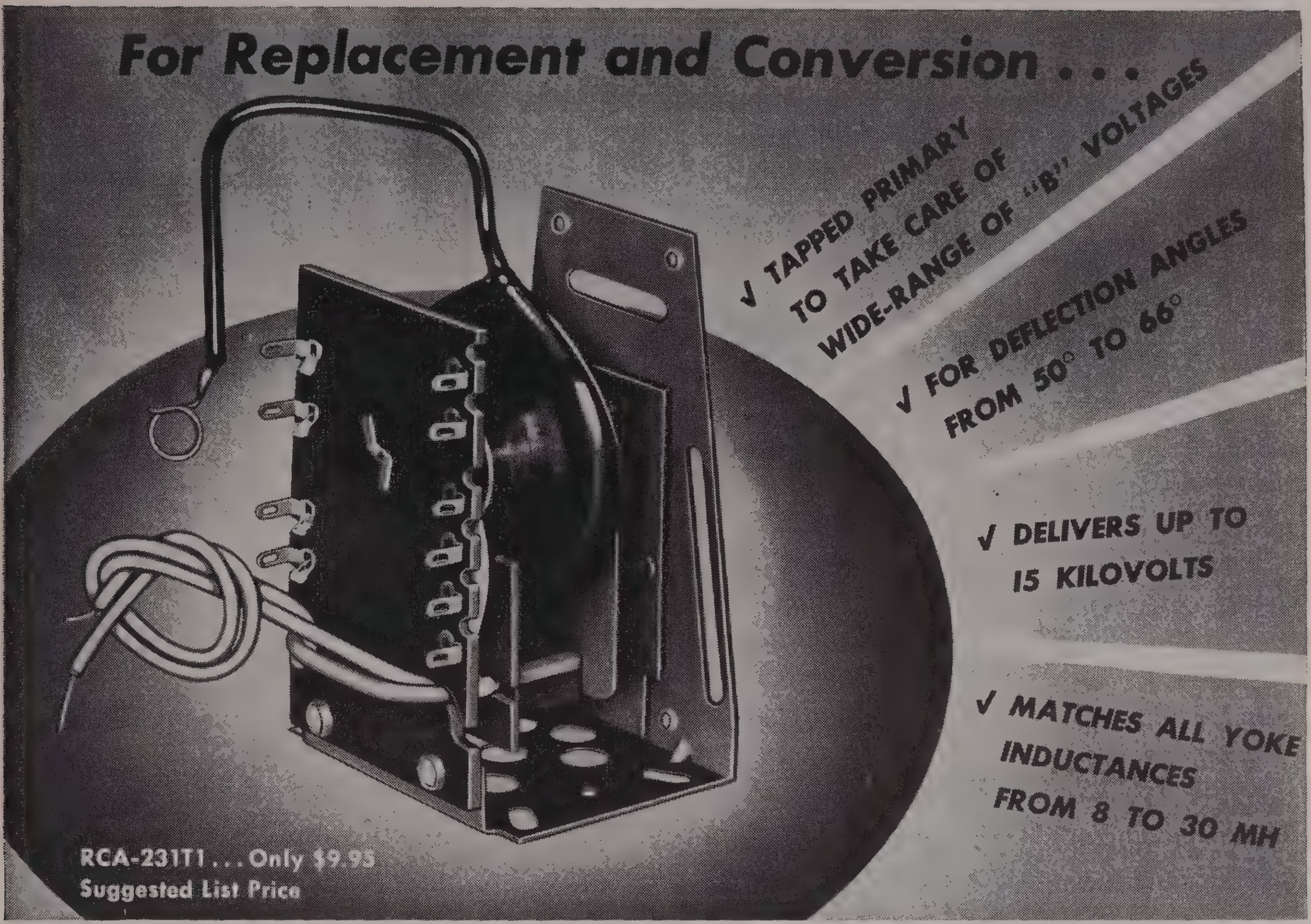


Fig. 4—(a) Positions of regulating-capacitor sections C1 and C2 in the circuit. (b) Operating characteristics of the new automatic voltage regulator.



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You've wanted it . . . here it is—the first *"universal-type"* horizontal output and HV transformer that solves virtually all replacement problems in TV receivers utilizing transformers which have isolated secondary windings. Because of its versatility, this new transformer is particularly suitable for conversion jobs.

Mechanically and electrically . . . the new RCA-231T1 meets practically every mounting and circuit requirement. With its 3 terminals on the primary winding and 7 terminals on the secondary winding, this universal-type transformer accommodates all standard driver tubes . . . assures a flexible and accurate match to an extremely wide range of yoke inductances . . . and provides excellent voltage regulation, ample width, and high voltage output. It uses a ferrite core for highest efficiency, cushioned to reduce 15-Kc acoustic radiation . . . and an arc shield to minimize corona problems. Provided with multiple mounting holes and slots, the RCA-231T1 can be quickly installed in practically all receivers.

Now, for the first time, you can simplify your stocking and servicing problems, with the new RCA-231T1 transformer for receivers using isolated-secondary-type transformers. Save yourself time and trouble . . . get a supply of 231T1's from your RCA Parts Distributor *today.*

RCA-201Y1
Converkit
Only $19.70 Suggested List Price

Handles picture tubes up to 21 inches in size and having horizontal-deflection angles up to 66°. Contains high-quality electronic components—an RCA-211D2 "Anastigmatic" Deflecting Yoke and an RCA-231T1 Horizontal-Deflection-Output and High-Voltage Transformer.

See your local RCA Parts Distributor for "Original" RCA TV Components.

tmks. ®

RADIO CORPORATION of AMERICA

ELECTRONIC COMPONENTS HARRISON, N. J.

the flexible plate will move away.

The new invention (Fig. 3) consists of a special capacitor with two fixed plates (A and C), and a single flexible plate (B). The capacitance BC (C1) is across the load; capacitance AB (C2) is part of the oscillator tank (Fig. 4-a). The oscillator is tuned to frequency P on the high-frequency side of the resonance curve (Fig. 4-b).

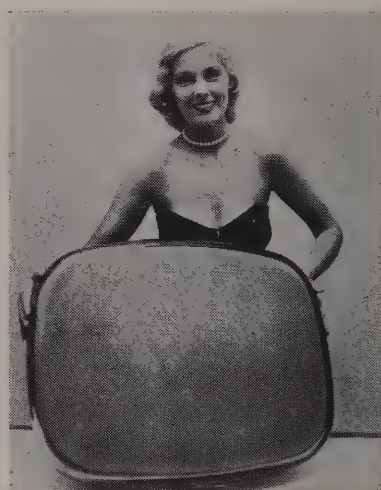
If the load voltage increases for any reason from its normal value at P to a new value represented by R, plate B of the special capacitor will be attracted toward C. This *reduces* the capacitance between B and A (C2) and automatically retunes the oscillator to the original frequency P, reducing the output voltage. Any drop in load voltage (Q) bends plate B away from C and closer to A, *increasing* C2 and tuning the oscillator back toward P.

In one form of the new device movable plate B may be a small vane attached to the pointer of a voltmeter across the load. The fixed plates A and C may be mounted on either side of the normal-output scale reading. Proper damping of the meter pointer and vane B will prevent sudden changes and "hunting".

—end—

NEW TUBES

Sample quantities of 27-inch rectangular picture tubes are being produced by RCA and Sylvania for set manufacturers working on 1953 models. No RTMA type numbers have been issued yet for these tubes. The RCA version is a metal-shell tube weighing 29 pounds, with aluminized screen and spherical frosted-Filterglas faceplate.



Sylvania's (shown above) is all glass, with a neutral-density gray-filter face plate. It uses magnetic deflection and focus, and has no external conductive coating. Recommended operating conditions for the Sylvania tube are: ultor voltage—20,000; grid 2 voltage—300; ion-trap magnet—45 gausses.

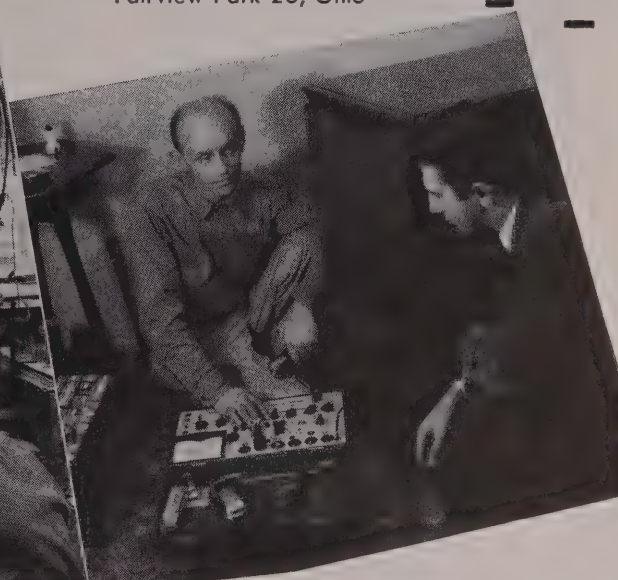
Both types are shorter than 21-inch picture tubes, and have 90-degree deflection. Screen size is approximately 18 x 24, with a picture area of about 400 square inches. Basing is standard.

—end—

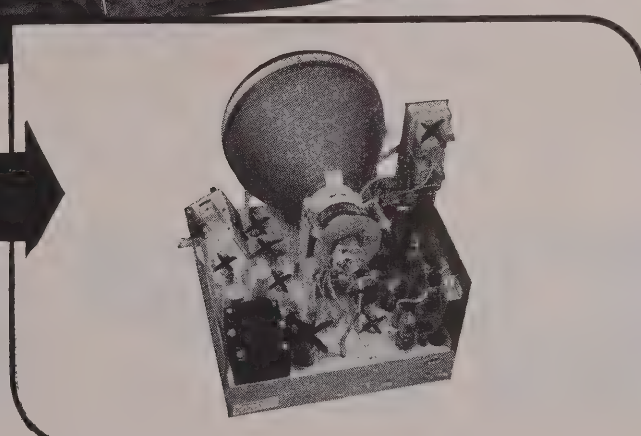
TESTING TUBES PAID FOR OUR *HICKOK* 605 IN LESS THAN A WEEK

Bill Schneider

Fairview Radio & TV Service
Fairview Park 26, Ohio



An average of 8 tubes will fail in a TV receiver every 6 months.



Read what Bill Schneider writes:

"Due to the highly efficient circuits of today's TV receivers, their Vacuum tubes are constantly pressed to their uppre limits. In order to produce a sharp clear picture these circuits must function perfectly at all times.

In our service work we find that every 6 months an average of 8 tubes fall below requirement standards in every TV receiver, due to use. Hickok tube testers are the only instruments to contain the dependable completeness of test necessary to accurately pick out below normal tubes. All tubes that the Hickok testers reject should be replaced to bring the receiver back to its manufacturer's standards.

We have continued to stand on the accuracy of our Hickok 533 and 534A shop testers for any tube test, so we decided to invest in another Hickok to build our income with increased "house-call" business. We chose the Hickok 605 tube tester because of its multimeter. For $12.60 more than the standard Hickok we got a built-in multimeter with a vacuum tube rectifier which is better than any other V.O.M. we could buy separately; even up to $50.00 as it will also measure capacitance. The complete Hickok 605 cost $167.60. With it we replaced 235 tubes in the first week of part time use. The profit on these tubes alone covered the cost of the 605 and gave us an additional small income on top of it. Our new, fast and accurate service has added many customers by way of recommendation, as well as a healthy increase in our shop service on more complete jobs.

As a special note, we have been averaging over 200 tubes a week ever since."

Sincerely, Bill Schneider.

MODEL 605 $167.60
WRITE TODAY FOR COMPLETE INFORMATION

THE HICKOK ELECTRICAL INSTRUMENT COMPANY
10531 DUPONT AVENUE • CLEVELAND 8, OHIO
THE STANDARD OF QUALITY FOR OVER 40 YEARS

AIMS AND OBJECTIVES OF A TECHNICIANS' GROUP

We have printed a number of *Codes of Ethics* of electronic service associations. The *Statement of Aims* below is considerably broader, since it includes the objectives as well as the ethical standards of the organization. It forms part of the constitution of the San Diego County Electronic Association:

We, the electronic technicians of San Diego County, deem it eminently right that we should organize for the development and improvement of our conditions, taking but a fair and just compensation, commensurate with the services rendered, so that equity may be maintained and the welfare of our Association be promoted. To this end the following objectives are promulgated:

To establish, promote and maintain a high standard of ethics, integrity, business practice, and service among members of this association.

To accept as members of this association only those people who will pledge themselves to uphold the standards, unity, and integrity of this association.

To publicize the ideals and objectives of this association for the purpose of inspiring public confidence.

To act as liaison between the public and members of this association.

To act as arbitrator in cases of public complaint involving members of this association.

To encompass a training program which will ensure the public of fully qualified technicians.

To assist civic groups and organizations to the best of our abilities.

To provide adequate apprenticeship training with proper supervision within this association.

To ensure the public of a flexible association which can readily modify its program as circumstances demand.

To foster close co-operation between members of this association with mutual support extended to every member.

To provide the public with a source of

"Since he discovered that old crystal set up in the attic, he hasn't any time for television!"

$4.00 opens up A NEW BUSINESS FOR YOU...

GOLDEN OPPORTUNITY FOR ALERT SERVICEMEN TO TURN $4.00 INTO HUNDREDS

The market is *wide-open*...a *ready* market...an actual *$70,000,000* Phono-Cartridge Replacement market. Facts and figures prove it! What an opportunity for you and every serviceman to get *new* business, *profitable* business you're not getting now!

ELECTRO-VOICE SHOWS YOU HOW...AND PAVES THE WAY

E-V helps you with everything you need to build a money-making Professional Phono Service business—New Sales Aid Kit, Manufacturer's Set Model Replacement Guide, Dramatic Direct Mail Campaign including Post Cards and Stuffers, Handbook on Cartridge Sales and Service, Professional Phono Service Sign, Window and Wall Streamers, Service Tags, etc. With these sales tools you can easily turn that $4.00 into HUNDREDS.

The E-V Basic 6 Preferred Type Cartridges enable you to make over 92% of all cartridge replacements and give immediate replacement service. Not only that... every E-V Cartridge now comes like a jewel in a new golden yellow, self-stacking plastic box.

It's the most powerful, most effective merchandising plan ever conceived in the phono service field!

Look for the Golden Yellow Cartridge Box

FREE

Send Now for Bulletin CP-1. Gives You the E-V Plan—Tells you How to Make $4.00 Open New Business for You.

Electro-Voice

421 CARROLL STREET • BUCHANAN, MICHIGAN

Export: 13 East 40th St., New York 16, U.S.A. Cables: Arlab

PHONO CARTRIDGES • MICROPHONES • HI-FI SPEAKERS • TV PRODUCTS

ELECTRO-VOICE, INC.
421 CARROLL STREET
BUCHANAN, MICHIGAN

Please Rush FREE Bulletin CP-1

NAME__________

ADDRESS__________

CITY__________ ZONE____ STATE______

MY DISTRIBUTOR'S NAME__________

reference or guidance for those who may desire this type of service.

To provide satisfactory policing of the members of this association.

To provide members of this association with the means of public expression.

To provide the members of this association with a means of closer contact with each other and with all peoples of the electronic industry.

SAN DIEGO USES TV

The San Diego County (California) Electronic Association is using a series of spots on the local TV outlet KFMB-TV. Called "Symbols of Trust," the presentation has caused many housewives to ask TV technicians for their credentials when they arrive on neighborhood repair calls.

The Association has embarked on the first step of a plan for a program of contributions of their time and talent to worthwhile organizations by presenting a television projector to the San Diego Children's Convalescent Hospital.

Regular technical meetings are expected to keep the members abreast of new developments in the field. One of the most recent, held June 25th, was addressed by Robert Jablonski of Hoffman Radio and Television Corporation, and by James G. Duncan, of KFMB-TV, San Diego.

MIAMI PROGRESSES

The latest monthly letter of the Radio & Television Technicians Guild of Florida shows great improvement over previous issues. Nicely printed on 12 pages of slick paper, it contains considerable advertising and boasts an advertising manager, Robert Martin.

It starts out with a full-page editorial on u.h.f., and contains a column of local news on the distributors and countermen, as well as a page of local news ("Association Notes"). We learn that heavy preparations for the annual picnic were being made at the time of writing, and that the last Blood Bank drive meeting was a great success, due in no small part to the efforts of C. R. Gunn. The magazine also welcomes Bernard Williams as circulation manager and Ed Stevens as official photographer.

TECHNICIAN ELECTROCUTED

Frank Freudinger of Chicago was killed by contact with the high-voltage system of a TV set on which he was working, reports TISA.

This death of a qualified technician, TISA points out, is a particular warning against the use of fix-it-yourself books by the public. If a man who knew exactly what he was doing could get himself killed, laymen who are not familiar with the dangers are exposed to far greater risk. "Pulling the plug" as advised by the books does not necessarily eliminate the danger. Capacitors have been known to retain a charge for six months. And no amount of plug pulling can eliminate the danger of an imploding picture tube.

TISA EXPELS

The following special bulletin was received from the Television Installation Service Association of Chicago:

> Please be advised that Central Television Service has been expelled by this association by unanimous vote at the regular TISA meeting of July 2, 1952.
>
> Henceforth, they are to be accorded none of the privileges of membership.

A report on the same meeting warns members against "gimmicks" and "gimmick advertising" and instructs all members to clear their ads with the Executive Board, to the end that plans and devices that reflect unfavorably on TV or the TV service industry may be eliminated.

JOINT PENNSYLVANIA OUTING

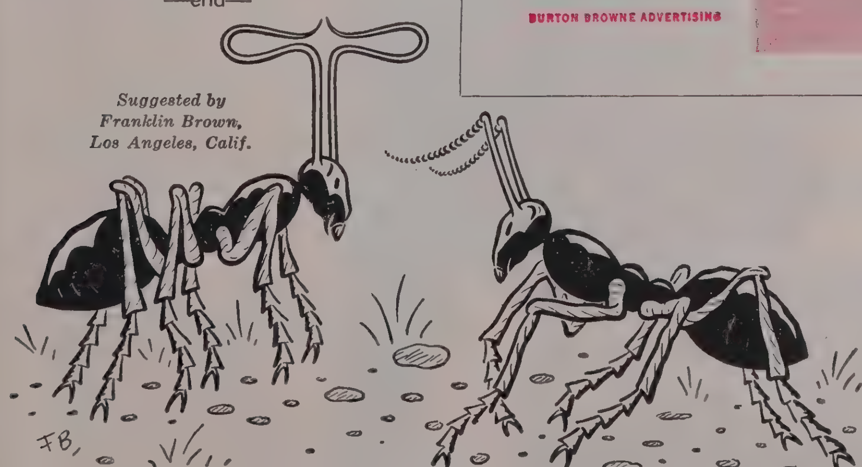
The Lackawanna (Pennsylvania) Radio Technicians Association played host to the State organization and the National Electronic Technicians and Service Dealers Association (NETSDA) on July 20th, with a joint meeting and clambake at Lilly Lake. A number of matters vitally affecting the welfare of electronic technicians was brought up for discussion, and important decisions were reached on action to protect the interests of the membership.

TV TECHS QUIT MEETING

Protesting an "unneutral" attitude on the question of licensing, about 50 service technicians and officials of radio and TV repair concerns walked out of a Washington, D. C., meeting sponsored by a local distributor. The meeting, according to Norman Selinger, secretary of the local TV technicians' organization, was supposed to present "strictly neutral views on the issue of licensing radio and TV service technicians." After the first speaker, the admittedly anti-licensing Louis B. Calamaras of the National Electronic Distributors Association, had presented the case against licensing, local technicians asked for an opportunity to present the views of pro-licensing technicians in rebuttal. When this was denied or delayed, the pro-licensing technicians left the meeting.

Besides Mr. Calamaras, the meeting was addressed by John F. Rider and by Frank Mansfield, research expert of Sylvania Electric Products, Inc.

—end—



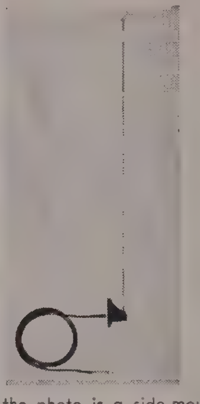
Suggested by Franklin Brown, Los Angeles, Calif.

"It'll make 'em feel at home."

New Devices

MOBILE ANTENNA

Brach Manufacturing Corp., 200 Central Ave., Newark, N. J., announces a new high-frequency antenna (No. 475), covering 152 mc to 162 mc, for automobile communications systems.

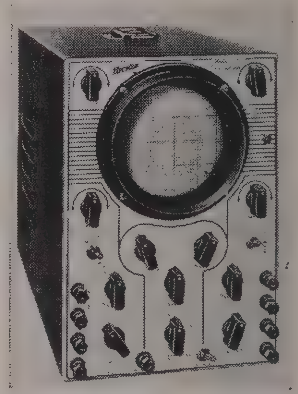


The antenna is designed for roof-top mounting, with a locking device which bites into the metal roof, making it unnecessary to scrape the mounting surfaces to establish a ground connection.

The antenna portion is made of beryllium copper and is pressure-fitted into a locking nut. The model 476 shown in the photo is a side-mount adaptation of the 475.

FIVE-INCH OSCILLOSCOPE

Hickok Electrical Instrument Co., 10514 Dupont Ave., Cleveland 8, Ohio, has released the new model 670 5-inch oscilloscope for visual alignment of AM, FM, and TV receivers when used with a sweep generator. The vertical-amplifier input impedance is 2.2 megohms shunted by 30 μμf; deflection sensitivity is .01 volt r.m.s. per inch. Pulse rise time is 0.6 μsec. The horizontal amplifier has a sensitivity of .07 volt r.m.s. per inch, input impedance of 1 megohm shunted by 35 μμf, response from d.c. to 250 kc, pulse rise time 1.2 μsec.



When the signal is applied directly to the deflection plates, vertical and horizontal sensitivities are 12 and 13 volts r.m.s. per inch respectively, and input impedances are 3.3 megohms.

The sweep oscillator is variable from 3 to 50,000 cycles with fixed sweep frequencies at 30 and 7,875 cycles. The 670 features controls for selecting negative or positive sync, horizontal sweep reversal, reversal of vertical deflection, Z-axis modulation, and a built-in detector for viewing modulation on r.f. signals.

The scope consumes 65 watts from a 117-volt, 60-cycle a.c. line, weighs 28 pounds, and is housed in a cabinet 9¼ inches wide, 12¼ inches high, and 18 inches deep.

NEW TV ACCESSORIES

Radio Merchandise Sales, Inc., 1165 Southern Blvd., New York 59, N. Y., announces the development of four new accessories for television installation: a thermal switch, 2-set coupler, local-distance switch, and a 4-channel switch.

The model TH-SW thermal switch, permits automatic operation of lamps, rotor, booster, and similar devices through the TV receiver. The model 4CS channel switch will switch four antennas into one receiver, or will operate any one of four receivers from a single antenna. The unit is engineered to reduce the coupling effect between the antenna in use and those which are idle.

The local-distance switch eliminates the overload which causes either a

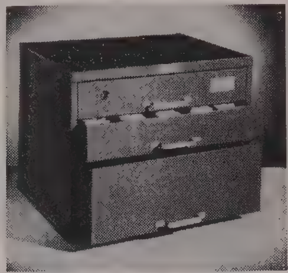
buzz in sound, or darkening of the picture in strong-signal areas. The switch, model LDS, is inserted in the antenna circuit. When overload occurs, the switch is moved to LOCAL position. This attenuates the signal and in turn eliminates the overload.

The AC-2 2-set coupler permits operation of two sets from a single antenna. It distributes the signal equally to both receivers, and there is

no limitation as to its location or length of lines between the coupler and either set.

NEW SWITCH KITS

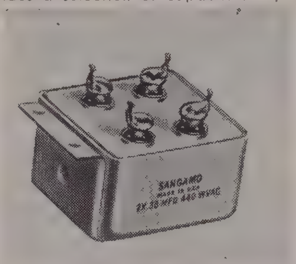
The Centralab Division of Globe-Union, Inc., 900 E. Keefe Ave., Milwaukee 1, Wis. announces the availability of its newly-revised 414 and 419 switch kits, which consist of the latest switch parts in a 17 x 11-15/16 x 12¾-inch metal cabinet. Kit 414 has 111 phenolic switch sections, 31 index assemblies, and complete hardware



consisting of knobs, brackets, tie rods, spacers and dial plates.' Kit 419 contains 81 steatite-ceramic switch sections, 27 index assemblies, and complete hardware. Both switch kits are described in detail in bulletin 42-138 available from the manufacturer.

CAPACITOR NETWORK

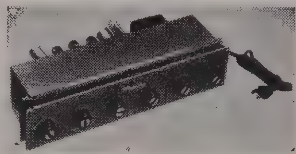
Sangamo Electric Company, Marion, Ill. has announced development of the type BTN capacitive network, a multi-section, metal-encased, hermetically-sealed paper-dielectric unit. It provides a selection of capacitive Pi, Y,



or Delta networks. Type BTN can be provided with mineral oil, pentachlordiphenyl, or electrical-grade waxes as impregnants. Units are supplied in ferrous or nonferrous cases. Complete data available from manufacturer.

PICKERING EQUALIZER

Pickering and Co., Inc., Oceanside, N. Y., is distributing the new 410 audio input system (equalizer-preamplifier) designed to serve as an audio control center. Three input channels are provided: two are for high-level audio signals and one for magnetic type pickups. The pickup channel provides 40 db gain at 1,000 cycles and 6 db per octave of bass boost below the low-frequency turnover. It is self-powered, operates from a 115-volt a.c. line. Three a.c. outlets on the rear of the chassis are controlled by the a.c. switch on the panel, permitting this unit to be used as a master control for other components of the system.



Its design features include:

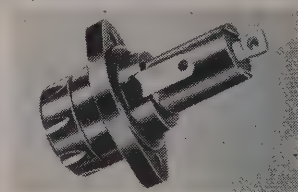
1. An accurately equalized preamplifier for all magnetic pickups.
2. A 3-position record compensator which correctly matches the characteristics of popular types of recordings.
3. Step-type low-frequency control having 5 positions of bass boost.
4. Step-type high-frequency control having 4 positions of high-frequency rolloff and one position of high-frequency boost.
5. Minimum intermodulation and harmonic distortion.
6. Extremely low noise and hum level.
7. Compact in the vertical plane for easy mounting in any cabinet.
8. All electrical outlets and connections as well as the vacuum tubes are located on the rear of the chassis.
9. Cathode-follower output allows the main amplifier and speaker system to be located for best acoustic performance, at distances as great as 100 feet from the control center.

12-ELEMENT TV YAGI

The LaPointe Plascomold Corp., Rockville, Conn., announces its new Vee-D-X *Long Long John* 12-element, single-channel series of TV antennas. The antennas feature ruggedized construction with V-shaped boom braces and reinforced element stampings, full 6-mc bandwidth, and high front-to-back ratio.

WATERTIGHT FUSE POSTS

Littelfuse, Inc., 1865 Miner St., Des Plaines, Ill., announces a new watertight fuse-extractor post for 3AG, 4AG, and 5AG fuses. Molded of black bakelite, leakage is prevented by inserting body contacts at the time of molding.

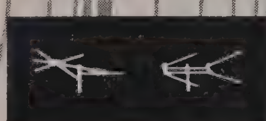


Rubber rings seal the front panel and the knob seats squarely in the shell. One-piece terminals and welded joints reduce voltage drop. Ease of extraction is insured by a leaf-spring grip on the fuse. There is no danger of shock while removing the fuse from the post by hand.

A properly selected **RMS** antenna helps you do...

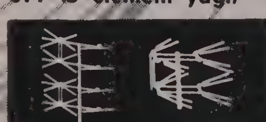
THE BEST JOB IN YOUR AREA

HOW TO SELECT THE PROPER RMS ANTENNA FOR YOUR PARTICULAR INSTALLATION



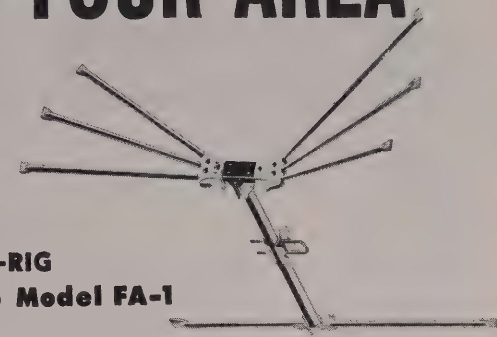
• *up to 25 miles* — FA-1 OR VA-100

• *up to 60 miles* — FA-2, CVA-500, STY (5 element yagi)



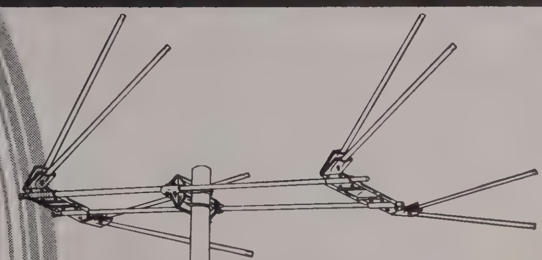
• *up to 85 miles* — FA-4, CVA2-500

• *over 85 miles* — CVA4-500, STYL8—, STYL10—



REDI-RIG
RMS Model FA-1

- *Completely preassembled — no loose parts or hardware.*
- *Exceptionally flat response across entire tv band.*
- *⅜" dowel-reinforced aluminum elements.*
- *Plus six other distinctive mechanical and structural advantages!*



FRINGELEADER END-FIRED ARRAY
RMS Model CVA-500

- *Completely preassembled.*
- *High gain on all channels.*
- *⅜" dowel-reinforced aluminum elements with unique double U-bolt attachment to the mast.*

SUPER STEEL-BRACED YAGIS

RMS Model STYL8-

- *Cut for specific channel — one of the highest gain antennas in use today.*
- *Steel brace assures permanent orientation.*
- *Deluxe construction and engineering features — the fastest installing long boom yagi on the market!*

SEE YOUR RMS JOBBER

RMS

2016 BRONXDALE AVENUE • NEW YORK 60, N. Y.

ANTENNA MANUFACTURERS ASSOCIATION

EQUALIZER PREAMP

The Radio Craftsmen, Inc., 4401 N. Ravenswood Ave., Chicago 40, Ill., have added the model 300 equalizer-preamplifier to their line of high-fidelity audio equipment. The unit is designed to control the response of an amplifier when fed from a tuner, microphone, or phonograph pickup.

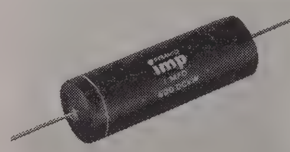
The unit has five main controls: a selector switch with positions for standard and LP pickups, microphone, and three high-level inputs. (Input impedance of the high-level channels is 500,000 ohms, and 1 megohm for the microphone channel. The impedance of the phono channel is matched to the cartridge.) Separate bass and treble controls are continuously variable to provide up to 16-db boost or attenuation. The power on-off switch controls the built-in power supply and associated units which may be plugged into the power receptacle at the rear. It has a volume-compensated loudness control.

Secondary controls are: Low-frequency equalization lever with turnover positions marked LP, 300, and 500 cycles. High-frequency equalization lever which provide droops of minus 4, 8, 12, and 16 db at approximately 10,000 cycles. Low-range lever with five filter positions for reducing hum and motor rumble. High-range lever with five positions for reducing hiss and record scratch. Loudness-volume lever which allows the use of a conventional volume control without loudness compensation.

The unit uses one 12AV6 and four 12AX7's in a circuit which includes a dual-triode phono preamplifier with selective feedback for equalization, two cathode-follower-driven grounded-grid amplifiers for tone compensation, and two cathode followers for input and output of the common high-level channel. Maximum gain is 26 db in the high-level channel and 58 db for phono and microphone.

PAPER CAPACITORS

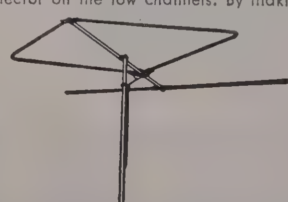
Pyramid Electric Co., 1445 Hudson Blvd., North Bergen, N. J., is producing a new type of molded tubular paper capacitor. *Imps,* as the new units are called, are molded of thermosetting plastic which resists moisture and operates at temperatures ranging from −40° C. to +100° C.



Each section is noninductively wound, and is available in capacitance values ranging from .00025 to 0.5 µf in 200- and 400-volt ratings, and from .00025 to 0.25 µf in 600-volt ratings. Complete data is available on your own letterhead request from the manufacturer.

ALL-CHANNEL ANTENNA

The Gonset Co., 801 So. Main St., Burbank, Calif., is producing an all-channel v.h.f. antenna, the Gonset *Rocket,* which functions as a resonant unterminated rhombic antenna on the high channels and a folded dipole with reflector on the low channels. By making



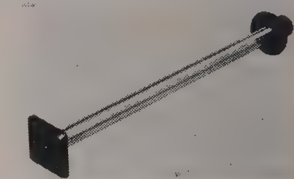
the legs three quarter-wavelengths long on the high channels, a good front-to-back ratio is obtained without a terminating resistor. The company claims the impedance match to 300 ohms is better than if a terminating resistor were employed.

On the low channels the functioning and performance are comparable to those of a conventional folded dipole. Gain and front-to-back ratio on the low channels are improved by a parasitic reflector. The antenna is assembled to speed installation time and prevent the loss of loose hardware. For fringe-area applications where more gain is needed, two- and four-bay stacking harnesses are available as extras.

TV WALL-THRU

Mosley Electronics, 2125 Lackland Rd., Overland 14, Mo., announced a new weatherproof TV or FM lead-in wall entrance that can be installed in any wall up to 13 inches thick. The Mosley *Wall-Thru* unit consists of precision-molded polystyrene inside and outside wall plates combined with a 14-inch extruded polystyrene tube, ¾ of an inch outside diameter. Both wall plates accommodate either standard flat 300-ohm transmission line or RG-59/U coaxial cable and are readily adapted for use with tubular type 300-ohm line.

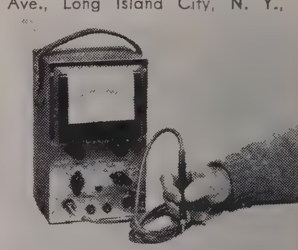
A universal TV lead-in socket may be mounted directly on the inside plate if desired, providing a solderless low-



loss plug-in connection of TV set to lead-in when used with a matching transmission line plug. The Wall-Thru is available separately or may be purchased complete with socket and mating plug.

TEST LEADS

Insuline Corp. of America, 36-02 35th Ave., Long Island City, N. Y., an-



nounces two new test leads designed to fit the RCA vacuum-tube voltmeter and others equipped with screw-on microphone type connectors. The No. 316 contains an isolating resistor in its probe and is intended for d.c. measurements; the No. 317 is a straight-through lead for utility applications. Each is 6 feet long, made of heavy, shielded wire. Handles are insulated.

YAGI ANTENNA

Channel Master Corp., Ellenville, N.Y., enters the low-priced Yagi field with

its *Challenger* 5-element Yagi antenna, series 550. Over 7 db gain is claimed on the single bay which matches 300-ohm line, and has a 5–1 front-to-back ratio. Noise interference is minimized. A transformer-type folded dipole made in one single assembly is built into the antenna. The director and reflectors, made of reinforced aluminum, are completely preassembled, and the 1-inch cross-arm has plugged ends.

—end—

All specifications given on these pages are from manufacturers' data.

IMPROVED PHOTOMULTIPLIER

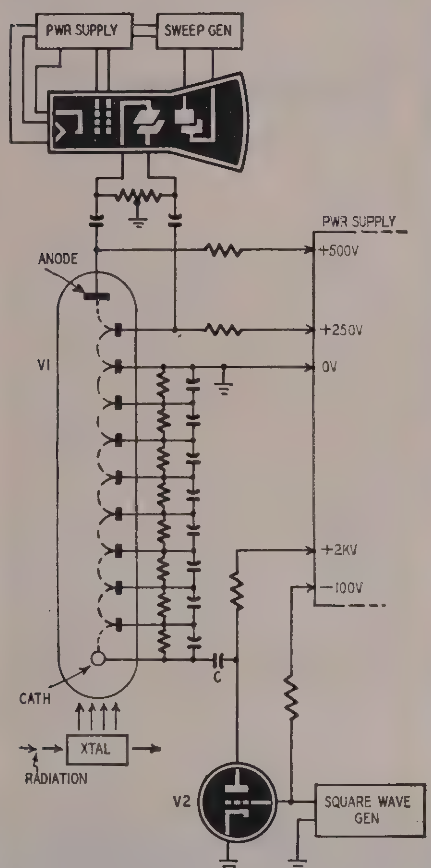
Patent No. 2,594,703

Louis F. Wouters, Oakland, Calif.

(Assigned to United States of America as represented by the U. S. Atomic Energy Commission)

This invention greatly increases the amplification of a photomultiplier tube by working the tube at higher-than-normal voltages. Power is applied intermittently so the tube does not overload. Although the peak voltages are high, the average power input is kept below the maximum limit.

The photomultiplier is shown as V1. It may be type 931-A which has a cathode, 9 dynodes (secondary-emission electrodes), and an anode. With constant input, the maximum limit for the tube is less than 1,250 volts. With this circuit we can use as much as 2,000 volts. It is applied through capacitor C.



V2 is a triode pulsed by a square-wave generator which alternately blocks and unblocks the tube. When V2 is cut off, C charges to 2,000 volts. At completion of the charge, no current can flow through the V1 voltage divider. Therefore the cathode of this tube has the same potential as the other elements and the tube does not operate. With V2 conducting, one end of C is effectively grounded. Thus the capacitor voltage (2,000 volts) is placed across V1. Each dynode now receives about 250 volts more than the preceding dynode. The phototube operates at high efficiency. The tube cannot overheat, however, since V2 blocks again and removes the input from V1.

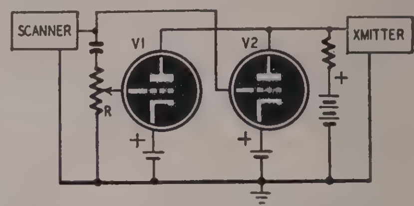
The figure shows a typical application for this circuit. A scintillation crystal is shown receiving radiation. The light flashes are converted to electron-emission pulses by the photocathode. While V2 is cut off these electrons return to the cathode. When a positive square wave from the generator overcomes the cutoff bias, V2 conducts and grounds the positive end of C. Electrons from the photocathode are drawn to dynode 1 and displace a large number of secondary electrons. These, in turn, are attracted to dynode 2, where they displace approximately double their own number. Current multiplication at each dynode is proportional to the applied voltage.

The greatly-amplified output signal between the last (ninth) dynode and the photomultiplier anode is applied across the vertical deflecting plates of a cathode-ray oscilloscope.

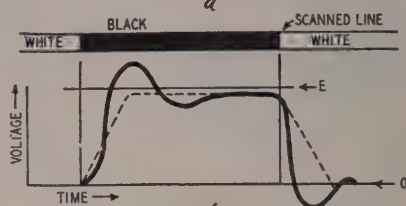
REDUCING FACSIMILE DISTORTION

Patent No. 2,587,617
Frank A. Hester, New York, N. Y.
(Assigned to Faximile, Inc.)

This circuit reduces distortion in facsimile signals. Much of the distortion is determined by the scanning aperture area. A small aperture means more lines per inch and relatively low distortion. Unfortunately, it also increases scanning time and requires greater bandwidth, so compromise is necessary.



a



b

This new circuit is especially effective when transmitted images are contrasty (like black-and-white printed matter). When a scanned image changes abruptly from white to black, or vice versa, the corresponding voltage output should be a perfect square wave. This is impossible with an aperture of finite area. The actual voltage rises gradually from zero to maximum when the image goes suddenly from white to black. The voltage drops gradually to zero when the image goes from black to white.

The new basic circuit is shown at *a* in the figure. The normal facsimile signal feeds V2 directly. Differentiated output feeds V1 as shown. In *b* the dotted line shows how the V2 signal varies as the aperture scans first white, then black, then white again. The differentiated V1 signal provides a peak which overshoots in the positive direction during a voltage rise. The peak overshoots in the negative direction during a fall in voltage. (See full line in *b*.) R determines the steepness of voltage rise and fall.

The output is limited to a maximum value E and it cannot drop below zero. Therefore the overshoots do not appear in the output. However, the combined output from V1 and V2 does approximate a square wave.

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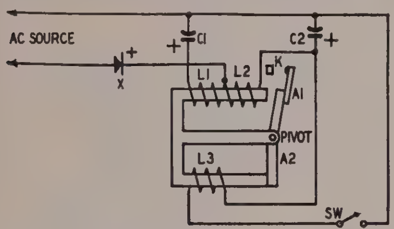
TIMING CIRCUIT

Patent No. 2,590,302

Clarence T. Evans, Wauwatosa, Wis.
(Assigned to Cutler-Hammer, Inc.)

This timer is suitable for use with electrolytic capacitors. Operated from the a.c. line, it is both efficient and reliable.

An E-shaped relay core is shown. The relay armature A1-A2 is pivoted on the center arm of the E. Because of its construction, one portion of the armature, either A1 or A2, touches the relay core and the other is pulled away. In the normal position shown here, A2 is attracted and A1 is pulled away, opening contacts K.



The center-tapped or "closing" coil L1-L2 tends to attract A1. The lower or "lockout" winding tends to attract A2. Each coil of the closing winding has more turns and greater magnetic force than the lockout coil L3.

When the timer is first connected to the line, rectified current flows through rectifier X into the center-tap. Equal currents flow in opposite directions through L1, L2, and charge electrolytic capacitors C1, C2. The armature remains in its normal position as shown because the electromagnetic fields of L1 and L2 buck each other. When the charge is complete, the current ceases.

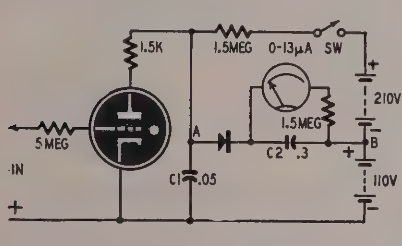
The timing interval begins with closure of SW. C2 begins to discharge through L3. As the voltage across C2 drops, it permits current to flow through L2 and L3. The magnetic force due to L2 increases with time until it is sufficient to draw A1 to the core, and the contacts K are closed. This ends the timing interval.

THYRATRON VOLTMETER

Patent No. 2,591,511

Alfred Gordon Clarke, Slough, England
(Assigned to Ronald Trist & Co., Ltd.)

Here is a circuit we seldom see: a gas-tube voltmeter. A thyratron is often used as a switch, for "on" and "off" applications. This inventor uses one of the cold-cathode type to measure d.c. The thyratron is rugged and requires no filament supply. In this circuit, there is negligible drain from the source.



When SW is closed, the power supply charges C1. The capacitor voltage rises until the tube fires. Then C1 discharges through the tube. The voltage of the capacitor drops until it is too low (about 110 volts) to support conduction. After the tube is extinguished, C1 charges again. This cycle recurs about 6 times a second. The voltage at point *A* rises and falls periodically. The peak varies with grid bias. With zero input, the tube fires at slightly above 110 volts. With a bias of about 50 volts, the plate potential may have to go as high as 160 volts to fire the tube.

The voltage fluctuations between A and B are smoothed by filter capacitor C2. The average value is measured by a sensitive microammeter. The rectifier permits C2 to charge rapidly but prevents it from discharging except through the meter.

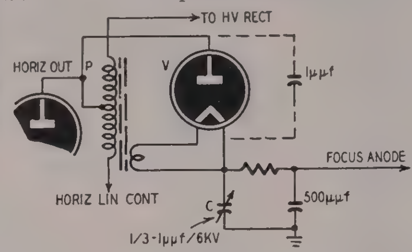
With zero input to this voltmeter, the potential at A will vary little from that at B. The meter will not deflect. With a large negative input, C1 can charge to a high voltage before the tube fires. This high peak at A will show up as a large meter deflection. The voltmeter can measure up to 50 volts.

The large grid resistor protects the tube and the signal source.

KINESCOPE FOCUS SUPPLY

Patent No. 2,588,652
Morris D. Nelson, Bronx, N. Y.
(Assigned to Radio Corporation of America)

The voltage supply for electrostatic focusing poses a problem. It may be obtained by a potentiometer across the kinescope h.v. source, but the potentiometer must impose only slight drain and must be well insulated. This invention solves the problem. It requires only a high-voltage rectifier tube and few other parts.

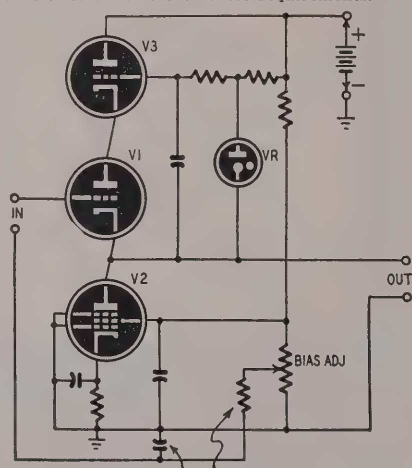


A capacitive voltage divider is connected across part of the horizontal output transformer. The peak voltage between point P and ground may be 6 kv. The divider is made up of a variable capacitor, C, and the internal capacitance of rectifier V. The latter is shown dotted. When C is set to 1 μμf, the output rectified d.c. is 3 kv. When it is set to 1/3 μμf, the output will rise to 4.5 kv. After filtering, the voltage is fed to the electrostatic focus anode.

LOW DISTORTION CATHODE FOLLOWER

Patent No. 2,592,193
Norman B. Saunders, Cambridge, Mass.
(Assigned to United States of America, as represented by the Secretary of War)

Cathode followers are known for low distortion. Under special conditions, distortion may be held as low as .01%. For such extra-low distortion, the follower d.c. plate current and the d.c. potential between cathode and plate must be constant. This circuit meets both these requirements.



FILTER FOR BIAS SUPPLY

V1 is the cathode follower. Its output voltage appears across the output terminals. V2 is connected as a constant-current pentode to control the average current flowing through the follower. Regulator tube VR maintains a constant voltage between the V1 cathode and the V3 grid.

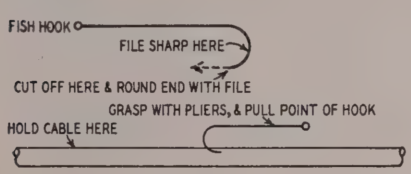
When a signal is applied to the input terminals, a signal voltage appears across the impedance formed by the external load across the output terminals paralleled by the plate-to-cathode impedance of V2. Since this impedance is in the cathode circuit of V1, a cathode-follower, the voltage on the cathode of V1 tends to follow the voltage applied to the grid. The voltage-regulator tube VR maintains a constant potential difference between the cathode of V1 and the grid of V3, therefore the signal appearing at the cathode of V1 is automatically transferred to the grid of V3.

Now, V3 is also a form of cathode follower so voltage at its cathode follows the voltage on its grid. Since the voltage between the grid of V3 and the cathode of V1 is constant, the signal voltages at the cathodes of V1 and V3 are in phase and nearly equal. The plate-cathode voltage of V1 remains substantially constant.

—end—

HANDY BRAID CUTTER

Sound installation men often waste a lot of time removing the heavy cotton braid which is usually used around multiconductor intercom cables. I find that I can do the job in half the usual time with the little tool shown in the drawing.



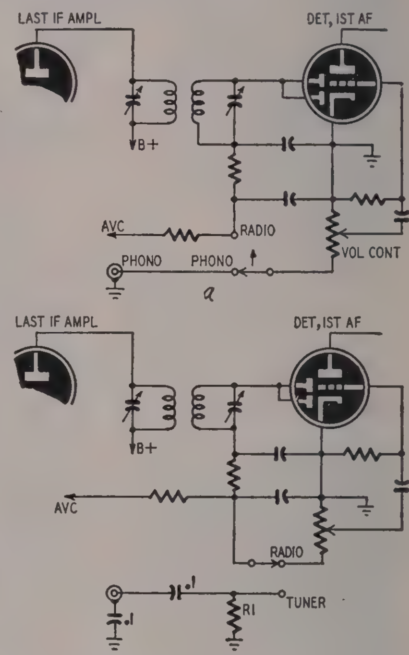
The gimmick is made from a large fishhook. Cut off the barb, sharpen the *inside* of the hook with a small file, then round off the end where the barb was clipped off. To use: Insert the point into the braid between two conductors. Grasp the shank of the hook with pliers and pull toward the end of the cable from which the braid is to be removed. —*O. C. Vidden*

MULTIMETER KINK

If you are planning to construct a multimeter, select a range switch which has an extra position on each wafer. Wire the extra contacts so there is a direct short across the meter when the switch is set to the off position. This short provides enough electrodynamic damping to prevent violent movement of the pointer, thus protecting the meter against damage by sudden shocks during transit.—*Charles Erwin Cohn*

USING RADIO AS TUNER

Many music lovers now have high-fidelity amplifiers which they use for phonograph reproduction. For radio reception, many of them have to be content with the poorer quality reproduction from the single-ended audio system and midget speaker used in many AM and FM radios. If the set has a phono input jack and switch, it is a simple matter to rewire the input circuit to the a.f. amplifier section so the set can be used as a tuner or straight radio simply by throwing a switch.



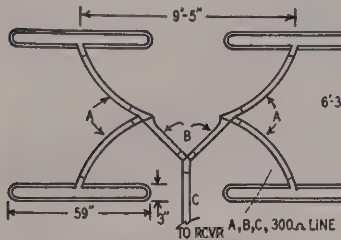
The drawing at *a* shows the detector, first audio, and phono input circuits of a typical receiver. The diagram at *b* shows how the arm of the PHONO-RADIO switch is removed from the hot side of the volume control and connected to a point on the detector load. Resistor R1 must be added to complete the detector load when the switch is in the TUNER position. The value of R1 should be the same as that of the volume control.—*William Dervin*

HIGH-GAIN FM ANTENNA

Reception of FM signals originating at stations 100 miles or more from the receiver is not unusual in good receiving locations. However, multiple paths often cause the signals to cancel at the receiving antenna and cause severe audio distortion. To eliminate this, we may either use a beam type antenna such as a Yagi or we use several interconnected dipoles spaced so that complete signal cancellation will not occur on all of them at any one time.

A 4-dipole array of this type is described in *Sylvania News*. Details of its construction are shown in the diagram. The dipoles, cut for the center of the FM band, are constructed from No. 8 aluminum wire. Connecting leads A may be any convenient length as long as all lengths are equal. Leads marked B are quarter-wavelength matching sections. They are each 26 inches long. All connecting leads are 300-ohm rib-

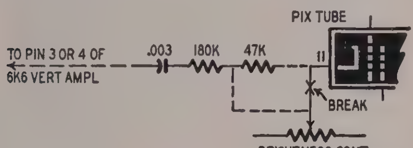
bon. Be sure that the phasing connections are as shown. The right sides of the dipoles are connected together and



brought to the same side of the lead-in. Orient all dipoles at right angles to the direction of the desired signals.

RETRACE BLANKING KINKS

I have developed a method of applying vertical retrace blanking to some sets without pulling the chassis. On the Zenith G2952R and similar models, I simply connect a 180,000-ohm resistor from the picture tube cathode (pin 11) to pin 9 of the dummy Phonevision plug on the rear of the chassis. A .002-μf capacitor is connected between this pin and the plate of the vertical output stage. The vertical signal is tapped off at this point and applied to the cathode of the picture tube to blank the retrace lines.



The diagram shows the details of a similar modification which I have made on Emerson 571 and 606 models. The .003-μf capacitor and the 47,000- and 180,000-ohm resistors are assembled on a small terminal strip. The lead between the picture-tube cathode and the brightness control is broken near the socket and the leads from the ends of the 47,000-ohm resistor are connected as shown by the dashed lines. The lead from the free end of the .003-μf capacitor is around either pin 3 or pin 4 of the 6K6 vertical amplifier tube. There is d.c. on this lead, so make sure that it does not short to the chassis.

—*F. H. Hanley*

CARRYING TV MASTS

If you are wondering how to get that length of TV mast or light wooden pole home without scratching the family car, try a set of the rubber suction cups and web straps used for carrying skis and fishing poles. You can purchase a set from an automobile appliance dealer for less than a single touch-up job would cost.—*Robert H. Mitchell, W6TZB*

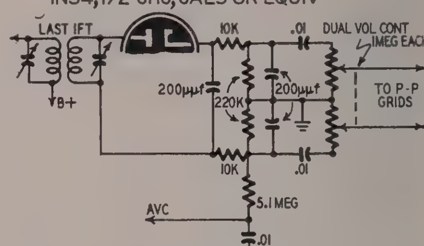
MIDGET SOLDERING IRON

When some of the midget or pencil-type soldering irons are used regularly, their wooden handles char and the barrel comes loose so the iron is practically useless. The iron can be repaired by packing asbestos furnace cement into the space between the barrel and the handle and letting it dry before handling.—*S. H. Beverage, W1MGP*

—end—

PHASE INVERTING DETECTOR

A push-pull output stage is often used in high-fidelity AM receivers. In such sets, it is normal procedure to use a phase inverter tube to drive the push-pull grids. In a recent issue of *Radio Constructor* (London, England), G. A. French points out that local stations most often listened to by hi-fi fans develop enough voltage at the output of the detector to drive the grids of a push-pull output stage. So, to eliminate the phase inverter tube, he has developed the phase-inverting detector shown in the diagram.



The diode load is the two 220,000-ohm resistors connected in series. The voltage developed across them is split into two equal signals of opposite polarity by the ground at the center of the load. The 10,000-ohm resistors and filter capacitors are arranged symmetrically around the center-tapped load. The 5.1-megohm resistor and the .01-μf capacitor are a.v.c. filter components. These may be omitted if the set does not use a.v.c. or if a.v.c. is supplied from a separate rectifier.

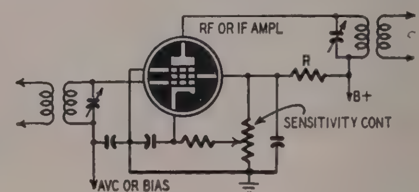
This circuit eliminates the drain of a phase inverter tube and the possibility of hum caused by heater-cathode leakage. If hum is introduced through the heater-cathode circuit of the detector tube, it can be eliminated by replacing the tube with a germanium diode.

(This item, while not new, has given good service, and is worthy of wider use. It was described in the article "12-Tube High-Fidelity Receiver" in Radio-Craft, February, 1936.—*Editor*)

NOVEL SENSITIVITY CONTROL

In many receivers, the sensitivity or r.f. gain control is a potentiometer in series with the cathode return of an r.f. or i.f. amplifier stage. Greater control of the gain can be obtained by modifying the circuit so the gain control is a bleeder connected between the screen grid and ground as shown in the diagram. When the control is turned toward the minimum-gain position, the voltage between screen and cathode is reduced, thus augmenting the gain reduction caused by the increase in grid bias. The dropping resistor R should be proportioned to give full screen voltage when the gain control is on full.

—*Charles Erwin Cohn*



NOVEL A.V.C. CIRCUITS

Some receivers use a separate a.v.c. rectifier like that shown in Fig. 1 instead of taking the a.v.c. voltage from

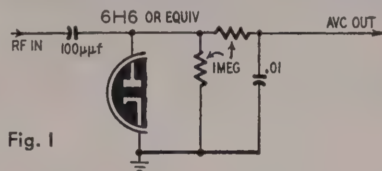


Fig. 1

the audio-detector load resistor. This separate diode rectifier can be eliminated in a number of circuits which are controlled by the voltage on the a.v.c. line. Tuning indicators and squelch-control circuits are typical of these. The circuit at *a* in Fig. 2 is a typical electron-ray tuning indicator arrangement.

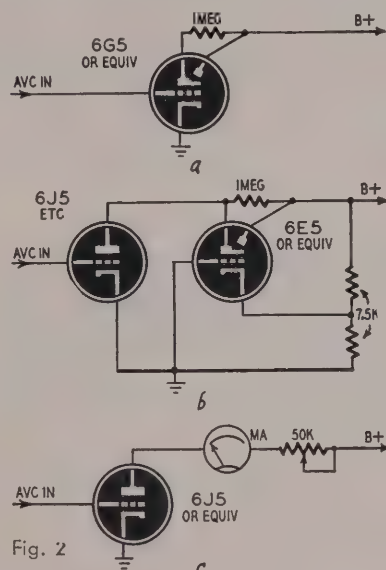


Fig. 2

The circuit at *b* is for the expanded shadow, and *c* shows a simple S meter.

In each of these circuits, we can substitute the control grid of the tube for the plate of the a.v.c. rectifier. The resulting circuits are shown in Fig. 3. The triode grids still get the required

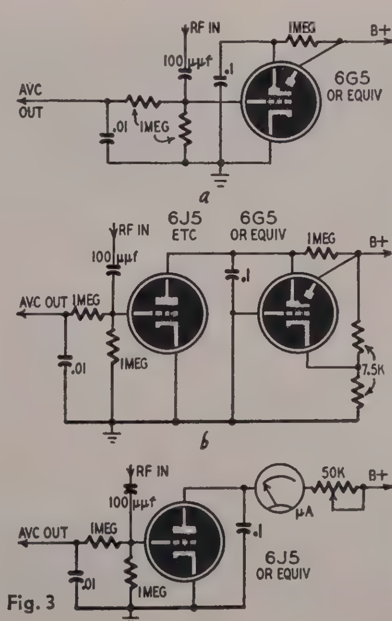
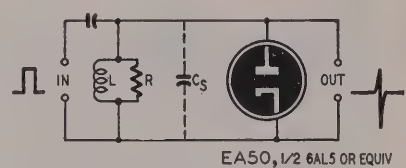


Fig. 3

a.v.c. voltage but they rectify it themselves. There is still a.f. voltage on the grids. This is usually eliminated by the a.v.c. filter network in the more conventional circuits. In the electron-ray tuning circuits, the audio signal may cause a fuzzy pattern. In this case, a 0.1-μf capacitor from the triode plate to ground will smooth it out. In the S-meter circuit (Fig. 3-c) the inertia of the pointer may give sufficient filtering. If the pointer vibrates with modulation, a 1.0-μf capacitor between the plate and ground will stop it.—*John Sareda.*

SHARP PULSE GENERATOR

This circuit, described by Messrs. Benson and Lusher in *Electronic Engineering* (London, England), produces very sharp pulses of a nature not easily obtainable with clippers and more conventional pulse-forming devices. When a positive pulse is applied to the input terminals, the tuned circuit consisting of L and C_s is shocked into oscillation. The circuit is tuned by C_s which is the sum of the plate-cathode capacitance of the diode and the distributed capacitance of the coil.



Resistor R damps the oscillations and shortens the duration of the wave train. The diode clips the positive peaks.

The rise time and amplitude of the output pulse depend on the values of the coil and the damping resistor.

When a 20-volt, 6,500-cycle pulse is applied to the input, and R is 3,000 ohms, the relationships between inductance, rise time, and output voltage are as shown in the table.

Inductance (μh)	Rise time (μsec)	Amplitude (volts)
400	0.8	1.60
180	0.6	1.35
33	0.5	0.30

If a positive output pulse is required, reverse the connections to plate and cathode of the diode. If further amplification is needed, substitute the grid of a triode for the diode plate in the diagram. The plate of the triode is connected to B plus through the usual plate load resistor and the output is taken from the plate through a suitable blocking capacitor.

EFFICIENT WHISTLE FILTER

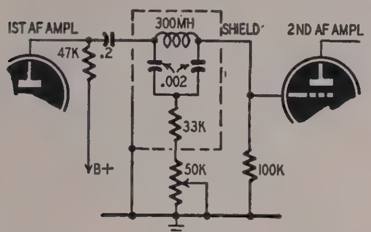
The average broadcast receiver or tuner lacks the selectivity required to pull in weak signals without heterodynes at the high-frequency end of the broadcast band. Since there is little that we can do to increase the selectivity without practically rebuilding the set, the only solution is to filter out the annoying whistles without adversely affecting the audio response of the set.

Details on constructing a heterodyne filter—sometimes called a "tweet" filter—are given in the diagram reprinted

from *Radio Constructor* (London, England). The unit consists of a parallel-tuned trap designed to be inserted between the first and second a.f. stages in a receiver, or between the tuner output and the input to the first audio amplifier stage.

The circuit is tuned to the interfering frequency by varying the capacitance or the inductance.

The former is usually found to be



the simplest unless you can get a coil (a 300-mh r.f. choke will do) with the required inductance and a variable powdered-iron core. With a fixed inductance, each of the .002-μf capacitors may be made up from a .001-μf mica capacitor paralleled by a 360-1,000-μμf mica variable capacitor of the type used for oscillator padding.

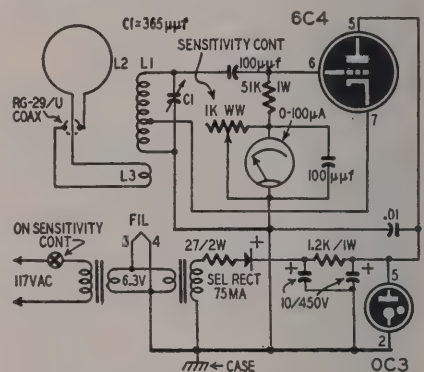
The L-C Circuit is sensitive to hum pickup so it should be carefully shielded. After tuning the network to the interference frequency, adjust the 50,000-ohm variable resistor for optimum results (greatest reduction in whistle with least deterioration of signal).

BROADCAST GRID-DIP METER

Many of us associate the grid-dip oscillator only with alignment and checking of h.f., v.h.f., and u.h.f. transmitting and receiving circuits. Actually, this handy instrument is equally useful at frequencies in and below the broadcast band. This grid-dip oscillator covers a frequency range from approximately 510 to 1800 kc and is described here through the courtesy of the Cornell-Dubilier Electric Corporation.

The oscillator is a 6C4 in a series-fed Hartley circuit tuned by a 365-μμf straight-line-frequency capacitor. Two 6.3-volt, 1-amp filament transformers connected back-to-back isolate the unit from the power line. L1 consists of 165 turns of No. 29 enameled wire wound on a 1-inch diameter polystyrene or low-loss bakelite form and tapped at the 55th turn from the ground end. L3 consists of 2 turns of No. 22 d.c.c. wire close-wound ¼ inch from the ground end of L1.

The 0C3 voltage-regulator tube helps maintain the necessary oscillator stability by holding the plate supply constant at 105 volts. It may be necessary to insert an adjustable 10K series resistor between the output end of the 1,200-ohm filter and pin 5 of the 0C3 to set the proper firing point, and limit the current through the regulator.



The pickup loop, L2, is a 2-inch diameter single turn of No. 12 insulated copper wire. It is mounted in one end of a length of ½-inch polystyrene tubing which serves as the handle. The pickup loop is connected to L3 through a 2-foot length of RG-29/U coaxial cable terminated in a RG-88/U male coax plug which fits into an RG-290/U socket on the panel. Other single-turn loops of larger and smaller diameters may be used for coupling to coils of different sizes. The only precaution is to make sure that the resonant frequency of L2 and the coax cable is well outside the broadcast band so it will not cause false indications.

A small sloping-front metal cabinet makes a convenient housing for the instrument and improves meter readability.

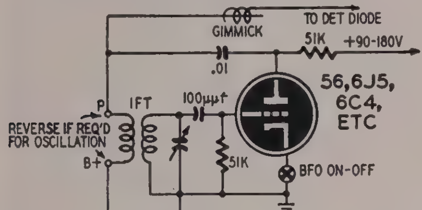
The instrument can be calibrated by beating its oscillator against broadcast stations picked up on a receiver. Begin at the low-frequency end of the band to prevent errors through accidental use of harmonics.

—end—

SW RECEIVER MODIFICATIONS

? *I have an all-wave broadcast receiver that covers all frequencies from the low end of the broadcast band to 60 mc. This set has one stage of r.f. and is very sensitive. How can I improve the selectivity and tuning so it will be easier to use on the amateur bands? Can I add a b.f.o. to the set?—E. S. K., Keyport, N. J.*

A. You can add electrical bandspread by connecting a small variable capacitor across the oscillator section of the main tuning gang and connecting this capacitor through a suitable shaft to a ver-



nier dial on the front panel. Better yet, use a three-section capacitor with one section connected in parallel with each section of the main tuning gang. This will improve tracking when using bandspread tuning. As an added refinement, you can connect a second variable capacitor across the antenna tuning section. This capacitor should be about 10 μμf maximum and is used to peak the input stage.

The drawing shows a typical b.f.o. circuit. You can use an old i.f. transformer for the b.f.o. coils. It should have the same frequency as the i.f. of your set. You can also use a 4-pie 2.5-mh choke. Connect a tap between the third and fourth pies for the cathode or ground connection and shunt the three pies with enough capacitance—about 75 μμf—to tune within a few kilocycles of the i.f.

Special transformers for b.f.o. circuits are supplied by several r.f. coil and transformer manufacturers. These are usually supplied with typical circuits.

For greater selectivity, we suggest that you add a Q-5'er having an i.f. of about 150 kilocycles or lower. Several surplus receivers can be used for this purpose. Their conversion has been covered in the various amateur publications.

ADMIRAL 21L1 TV SET

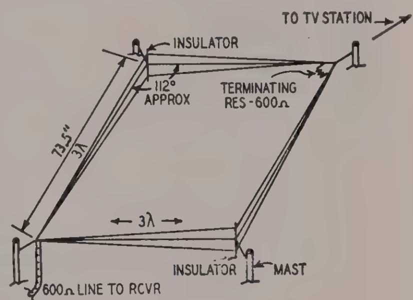
? *My Admiral TV receiver has poor horizontal sync. The picture rolls horizontally frame by frame. In checking the components in the horizontal sync circuit, I found a VR54 tube which I believe to be the sync discriminator. I can't find any data on it and can't get a replacement. Removing this tube from the set has no effect on the performance. Can you explain the purpose of this tube and recommend a replacement?—E. E., Bronx, N. Y.*

A. The VR54 is equivalent to the 6H6 and was used in a few Admiral chassis during a tube shortage. This tube is the sync discriminator and can be replaced by a 6H6.

U.H.F. RHOMBIC FOR TV

? *I want to construct a 3-wire rhombic antenna for u.h.f. TV channels 16 and 22. I would like the antenna to have as much gain as possible without exceeding 10 feet in length. Can you prepare a diagram of such an antenna?—R. C., Carbondale, Penna.*

A. If a rhombic is designed to operate with maximum gain over a wide range of frequencies, it should have as many wavelengths (at the lowest frequency) as possible in each leg. Therefore, it should be cut for the low-frequency end of channel 16 (492 mc). One wavelength in inches equals 11,800 divided by the frequency in megacycles. At channel 16,



one wavelength equals approximately 24.5 inches. Since the length of the rhombic is limited to 10 feet, you can use three wavelengths in each leg with an angle of approximately 112 degrees between adjacent legs of each side as shown in the diagram.

The construction of a three-wire rhombic is similar to that of a single-wire rhombic. However, each leg consists of three wires joined together at the ends and separating gradually as the junction of the legs is neared. At the side supports, the wires should be approximately 3 inches apart. Since all the wires are the same length, the two outside ones will be slightly farther from the supporting mast than the center ones.

The sharpness and the elevation of the major lobe are determined by the height of the antenna above ground and the included angle between adjacent legs at the sides. Raise and lower the terminated end of the antenna to determine the angle at which signal strength is maximum.

The 3-wire rhombic has an impedance of approximately 600 ohms so you should feed it with a 600-ohm open-wire line. A one-quarter wavelength matching section should be used to reduce the impedance to match the input of the receiver.

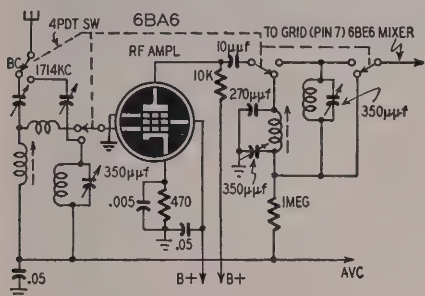
Although the diagram shows supporting masts, you can use crossed booms on a single mast.

AUTO RECEIVER CONVERSION

? *I would like to obtain directions for receiving 1714-kc signals on my Silvertone auto radio (chassis 528.6295-4). If a converter is required, it should take the necessary operating voltages from the receiver.—Wm. C. P., Waialua, Oahu, T. H.*

A. The simplest method of receiving

1714-kc signals on your set is to switch in pretuned antenna and r.f. coils as shown in the diagram. This will give you reception by the image method, without alterations to the receiver oscillator circuit. Your receiver has a 262-kc i.f., with the oscillator tuned 262 kc *above* the frequency shown on the dial. With the receiver dial set at 1190, the oscillator will be tuned to 1452 kc, which is exactly 262 kc *below* the desired signal frequency.



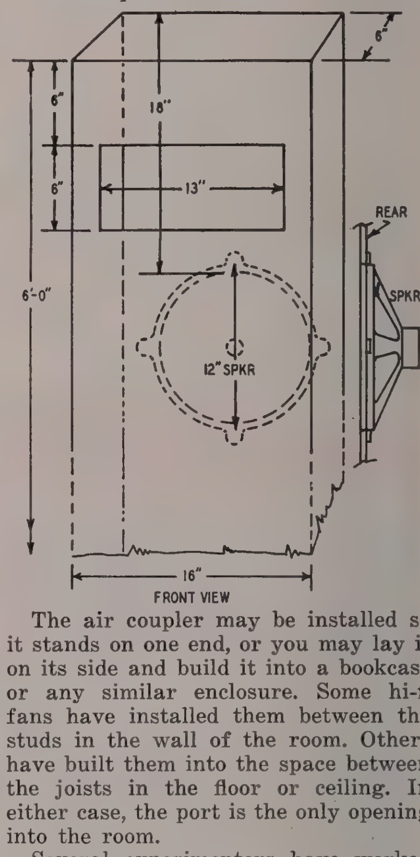
Miniature antenna and r.f. coils which tune to 1714 kc should be used. The coils and switch should be located close to the mixer and r.f. amplifier tubes. A small bracket or apron on the rear of the chassis will probably provide ample space for the added components. The switch can be controlled through a long flexible shaft.

For other frequencies a few kilocycles removed from 1714 kc, the receiver dial setting may be found by subtracting twice the receiver's i.f. from the desired signal frequency.

AIR-COUPLER DESIGN

? *I have heard a lot about the good low-frequency response that can be obtained from inexpensive speakers in air-coupler types of enclosures. Please print constructional details on this type of unit and tell me where I can find additional references on the subject.—A. C. D., Detroit, Mich.*

A. The drawing shows the air coupler described by the late Edmund T. Flewelling in the November, 1950, issue of *Audio Engineering.* The unit is constructed from boards or plywood at least three-quarters of an inch thick with a liberal application of wood screws. Note well that the speaker is mounted *outside* the rear wall of the column and that the rectangular port is the only opening in the front wall of the coupler.



FRONT VIEW

The air coupler may be installed so it stands on one end, or you may lay it on its side and build it into a bookcase or any similar enclosure. Some hi-fi fans have installed them between the studs in the wall of the room. Others have built them into the space between the joists in the floor or ceiling. In either case, the port is the only opening into the room.

Several experimenters have worked out interesting variations and improvements on the air coupler. The modifications include dividing the coupler into two air columns of different lengths to smooth out the response at the lower frequencies and adding a reflex arrangement and a second port to provide sound reinforcement from the rear of the speaker. These variations and improvements were described in *Radio Communication* for October, November, and December, 1950; February, October, and December, 1951; and February, 1952; and in the winter edition (Vol. 1, No. 3) of *High-Fidelity.*

The speaker itself must be rugged and have good low-frequency response. Some form of frequency-dividing network must be used to feed only the desired lows to the air-coupler unit.

—end—

RE: ARCING IN DEWALD SET

In the "TV Service Clinic" of the May, 1952, issue, a reader inquired as to the cause of arcing at the grounding springs on a DeWald receiver. The conditions explained by Mr. Mandl may exist, but a leaky high-voltage filter capacitor is by far the most common cause of this trouble. It is a common occurrence in the Admiral 21B1 and similar chassis.—*Robert Brown*

STABILIZING THE PILOTUNER

In the *Pilotuner* the 3-gang aluminum capacitor body is grounded by mechanical contact to the aluminum chassis in a bolted connection.

I have found that a low-resistance electrical connection from capacitor to chassis greatly improves performance and controls any tendency toward oscillation at the high end of the FM band.

This connection can be made by soldering copper braid from the r.f. coil connection at the rear, right end of the capacitor body to a tube socket rivet in the chassis.

The copper braid can be stripped from shielded cable if none is available, and about two inches will do the trick. The braid may be stiffened by tinning it beforehand.—*Howard Warriner*

KEY CLICKS ON HT-17

A fellow ham brought his HT-17 rig into the shack and asked my help in licking a bad case of key clicks. We tried the usual choke and capacitor combinations in the various well-known key-click filter circuits. All of these seemed to make conditions worse rather than better. Finally, we found the circuit and values that did the trick. We connected a 20-henry choke in one of the keying leads and a 0.5-μf, 600-volt capacitor *directly* across the key terminals. These values are exact for this particular rig. Substituting slightly different ones for either component will let the clicks come through as strong as ever.—*Gerald Samkofsky, W2YSF*

(The author mentioned that he is now trying to clean up severe TVI which occurs when the rig is used on 11-meter c.w. He would appreciate complete details from anyone who has licked the TVI problem on this rig.—*Editor*)

TENNA-TOP BOOSTER

When using the Electro-Voice Tenna-Top booster with the Du Mont RA-119-A receiver, shunt the relay in the junction box with a resistance of 0.1 to 0.2 ohms to prevent burnout. This resistance can be made up from five 1-ohm, 1-watt resistors connected in parallel. The present relay in the booster is designed to operate with receivers using a maximum of 500 watts. The RA-119-A draws 650 watts.—*Du Mont Service News*

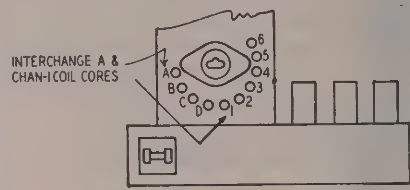
VR PICKUP CARTRIDGES

It has been found that open circuits in G-E variable-reluctance cartridges are usually caused by soldering the phono leads directly to the cartridge terminals. Excess heat produced during soldering burns the fine wire to the pickup coil and causes it to open. *Always* solder the phono leads to the push-on terminals supplied with the cartridge.—*G-E Radio Service Bulletin*

MODIFYING THE WR-59A

The RCA WR-59A TV sweep generator does not provide a 40–50-mc signal for aligning the i.f.'s of TV sets having intermediate frequencies in this range. However, this instrument can be modified to provide 41.25- and 47.25-mc signals at the r.f. output cable.

Interchange the coil core for the A band (10–11.5 mc) with the coil core for channel 1 (44–50 mc). The location of these cores is shown in the drawing. After interchanging the cores, adjust the core in the channel 1 coil to provide the correct center frequency. Proceed as follows:



1. Connect an oscilloscope to the video detector output of a properly-aligned operating receiver with a 45-mc i.f. channel.

2. Connect the r.f. output cable to the receiver's i.f. input.

3. Note the response curve on the scope and adjust the channel 1 core to get the desired frequency range.

4. Check the limits of the response curve with a TV calibrator or accurate marker generator.

The channel 1 position will now provide enough signal to align receivers having 45-mc i.f.'s. Note that this signal is available at the *r.f. output cable* and is controlled by the r.f. attenuator. —*Montgomery Ward's General Service Letter*

TELE-TONE MODEL 249

We have had a number of these sets brought into the shop with the complaint that picture height has reduced to only 2 or 3 inches. Although there are a number of possible causes for this difficulty, nine times out of ten we are able to locate the trouble in the height-control circuit. The 1.5-megohm resistor in series with the height control may have reduced to as low as 500,000 ohms or it may have opened up. In either case, replace the fixed resistor with a 1.5-megohm, 1-watt unit.—*Martin Rosenberg*

OLYMPIC 700 SERIES

Line-voltage surges often blow the fuse in the horizontal output circuit. This causes a small picture with fold-over on both sides and visible damping bars. To eliminate this condition: Remove the fuse from the present circuit and then remove the GREEN lead from terminal 1 of the horizontal output transformer and connect it to terminal 8. Connect the fuse between terminals 1 and 8. Remove the YELLOW lead from terminal 8 and reconnect it to terminal 7. Dress the fuse away from the high-voltage terminal and components.—*Olympic Television Service Bulletin*

RCA J2 RECORD CHANGER

When these changers continue to reject records or reject more than one at a time, the trouble can usually be traced to the cycling cam—a heart-shaped rubber-tired cam which operates the change mechanism. A small half-moon section of rubber has been removed from the cam to disengage the drive mechanism at end of change cycle.

The trouble occurs when the half-moon depression is too short. The inertia of the mechanism will cause the cam to coast across the space and re-engage the drive mechanism. The trouble is easily eliminated by elongating the cut-out section with a razor blade or a small hand grinder. Make the cut in the direction which will cause the drive to disengage sooner. Don't try to change the point at which it engages as this is controlled by the player mechanism.—*Joseph C. Burke*

SPARTON AM-FM CHASSIS

A few cases of AM drift have been reported on radio chassis types 6S10, 8L9, 8L10, 8M10, and 8S10. The cause was an incorrect value of grid resistor in the 6BE6 AM oscillator circuit. The correct value of this resistor is 22,000 ohms. Replace with a ½-watt unit if its value is incorrect.—*Sparton Service Division Bulletin*

20CP4 PICTURE TUBES

Underwriters' Laboratories requirements limit the maximum allowable capacitance between inner and outer conductive coatings of a TV picture tube to 250 μμf if a filter capacitor is used and to 750 μμf without a capacitor. This limits the outer aquadag band to a maximum width of 3 inches starting from the reference line. This narrow band does not provide sufficient radiation shielding, so it has been deleted from 20CP4's made by Hytron.

The exterior coating on Hytron 20CP4's is not the usual conductive coating. Instead, it is an insulating paint applied to improve the appearance of the tube.—*Hytron Engineering News Release*

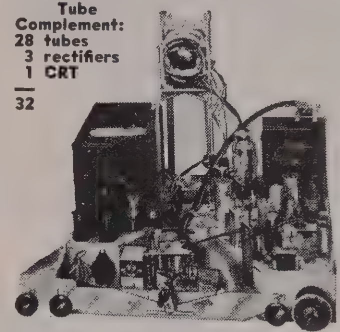
MECK 16-INCH MODELS

Failure of the 0.25-μf, 600-volt capacitor connected to the damper tube cathode and the horizontal-linearity control coil is a common complaint on some of these models. This capacitor is mounted close to the 6,000-ohm, 20-watt resistor connected between plate and cathode of the 6W4-GT. Heat from the resistor melts the capacitor's insulation and causes it to fail. Premature breakdowns can be avoided by moving the replacement capacitor to a spot where it will not be affected by heat from the resistor.—*Yuki Minaga*

G-E MODELS 610 AND 611

Always leave the A-battery in place in the cabinet, even if it is not connected to the circuit. The reason for this is that the loop is tuned with the battery in place. Removing the battery detunes the circuit and reduces the sensitivity of the set.—*G-E Radio Service Bulletin*

—end—

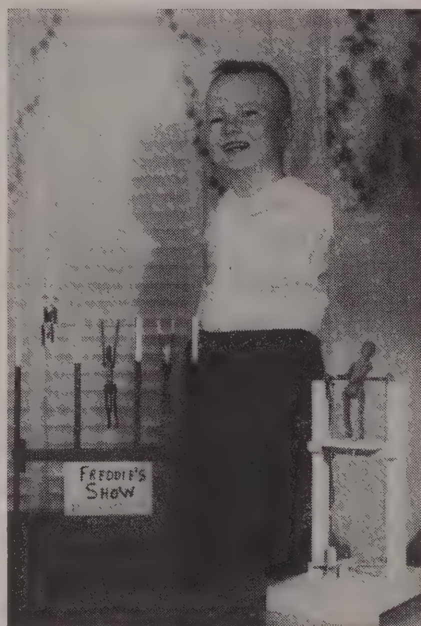


THE FUND NEARS $10,000

HELP-FREDDIE-WALK FUND

The Help-Freddie-Walk Fund recently received the following letter from Herschel Thomason, radio technician of Magnolia, Arkansas, and father of four-year-old Freddie Thomason, who was born without arms and legs.

"We received another batch of checks a few days ago and sure were glad to get them. We are very proud and thankful for the fund that is building up. We only wish that it were possible for us to thank the many thousands of people personally for the kind deeds



they have done in making Freddie's future a happy and secure one.

"Freddie is getting along fine these days and is walking quite a lot. He can pick up his artificial legs real good, but still is having a little trouble getting the forward motion."

We at RADIO-ELECTRONICS are as pleased as the Thomasons at the continued response to our appeals for funds, which now total almost $10,000. Please keep them coming; large or small, they will be gratefully acknowledged and sincerely appreciated. It is through the efforts of each and every one of us that Freddie will be assured a normal life.

We should like to take this opportunity to acknowledge with thanks a contribution of $150 from the Maintenance Directorate Office, Gentile Air Force Specialized Depot, Wilmington Pike, Dayton, Ohio, sent in by Wallace L. Horton, who writes: "We all sincerely hope that the money may help, in some small way, to keep Freddie on his feet. The personnel here are engaged in the maintenance of radio and radar equipment and naturally have a very soft spot in their hearts for Freddie."

The Boys of Thomasson Television Service, Danville, Virginia, sent in $5.00, "Just to wish you the very best of things in life," and a contribution of $8.00 has been received from Leonard S. Kleinfeld, in the name of the Television Engineering Class T-16, American Television Institute, Chicago, Illinois. These, too, we would like to acknowledge with thanks.

Please send your contributions from time to time. *Make all checks, money orders, etc., payable to Herschel Thomason.* Address letters to:

HELP-FREDDIE-WALK FUND
c/o RADIO-ELECTRONICS Magazine
25 West Broadway
New York 7, N. Y.

FAMILY CIRCLE CONTRIBUTIONS

Balance As Of June 19, 1952	$ 553.50
Mrs. Bert Wasserman, Venice, Calif.	$ 5.00
FAMILY CIRCLE CONTRIBUTIONS As Of July 18, 1952	$ 558.50

RADIO-ELECTRONICS CONTRIBUTIONS

Balance As Of June 19, 1952	$9,101.26
Anonymous, Peoria, Ill.	3.00
W. L. Barth, York, Pa.	2.00
Grady Bassham, Poplar Bluff, Mo.	5.00
J. Bilkin R/O, S.S. Liberty F, New York City	10.00
Paul Blum, Newark, N. J.	1.00
Boys of Thomasson Television Service, Danville, Va.	5.00
Crescent Industries, Inc., Chicago, Ill.	10.00
A. J. Curtin, E.T. 2, Bayonne, N. J.	5.00
H. J. Daly, Chicago, Ill.	2.00
Pvt. Lane Dam, Fort Ord, Calif.	1.00
Hamilton Radio-Television Shop, Dewitt, Ark.	10.00
Personnel of the Directorate, Maintenance - Engineering, Gentile Air Force Specialized Depot, Dayton, Ohio	150.00
E. O. Roehr, St. Louis, Mo.	5.00
Bob Smith, Ocean Park, Maine	1.00
Barbara Stevens, Jasper, Alabama	1.00
RADIO-ELECTRONICS CONTRIBUTIONS As Of July 18, 1952	$9,312.26
FAMILY CIRCLE CONTRIBUTIONS	558.50
TOTAL CONTRIBUTIONS to July 18, 1952	$9,870.76

Radio Thirty-Five Years Ago
In Gernsback Publications

HUGO GERNSBACK
Founder

Modern Electrics	1908
Wireless Association of America	1908
Electrical Experimenter	1913
Radio News	1919
Science & Invention	1920
Television	1927
Radio-Craft	1929
Short-Wave Craft	1930
Television News	1931

Some of the larger libraries still have copies of ELECTRICAL EXPERIMENTER on file for interested readers.

SEPTEMBER 1918
ELECTRICAL EXPERIMENTER

Cold From Electricity, by H. Gernsback
U.S. Signal Corps Radio Outfit in France
Cruft High Tension Radio Laboratory
The Einthoven Galvanometer, by Samuel D. Cohen
Graph for Solving Wave Length, Frequency, Inductance, and Capacity
Vest Pocket Radio Set, by A. V. H. Walsh
Unique Scheme for Code Learning, by L. A. Gary
A Miniature Radio Buzzer, by Harold Lewis

ELECTRONIC LITERATURE

Any or all of these catalogs, bulletins, or periodicals are available to you on request direct to the manufacturers, whose addresses are listed at the end of each item. Use your letterhead—do not use postcards. To facilitate identification, mention the issue and page of RADIO-ELECTRONICS on which the item appears. All literature offers void after six months.

VEE-D-X CATALOG

The LaPointe Plascomold Corp. has issued a new 23-page illustrated catalog describing VEE-D-X TV antennas, towers, boosters, and accessories.

A copy of catalog No. 52 is available upon request to The LaPointe Plascomold Corp., Rockville, Conn.

ELECTRONIC FLASH HANDBOOK

The Sprague *Electronic Flash Handbook* is a 14-page, 8½ x 11-inch booklet on constructing four different low-voltage electronic flash outfits designed around Sprague's low-leakage electrolytic capacitors and the latest types of flash tubes.

A copy of the handbook (No. C-703) can be obtained for 35¢ from Sprague dealers, or from Sprague Products Co., North Adams, Mass.

CONDENSED CATALOG

Electro-Voice has issued a new condensed catalog No. 113. Microphones, phono-cartridges for all three speeds, hi-fi speakers, drivers, horns and crossovers, folded-horn corner enclosures, 2-, 3- and 4-way speaker systems, automatic self-tuning Tune-O-Matic and Tenna-Top boosters, and the TeleVider distribution system for multiple TV installations are described and illustrated.

For free copy write to Electro-Voice, Inc., Buchanan, Mich.

TV TUBE COMPLEMENTS

Sylvania's new enlarged third edition of its *Television Receiver Tube Complement Book* lists receiving and picture tube types for nearly 4,000 different TV sets now in home use. Receivers are listed alphabetically by manufacturers, and the total number of tubes required for each is also given.

Copies of the 120-page wire-bound book may be obtained for 75¢ from distributors or the Advertising Department, Sylvania Electric Products Inc., Emporium, Pa.

PHONO NEEDLE CATALOG

Full information on every known type of needle replacement appears in the Jensen Industries' phono needle catalog No. 52. The 16-page brochure is cross-referenced according to phonograph manufacturer, cartridge manufacturer, and competitive needle sources. Information is also supplied on Jensen's magnetic recording tape.

Available free from parts distributors or direct from Jensen Industries, Inc., 329 S. Wood St., Chicago 12, Ill.

—end—

R. L. Triplett, president of TRIPLETT ELECTRICAL INSTRUMENT Co., Bluffton, Ohio, was presented with a gold watch by his sales force on the occasion of his

Mr. Triplett (right) accepts 50-year award from E. K. Seyd, as A. D. Plamondon, Jr., RTMA Chairman, looks on.

50th year in the industry. The presentation was made by E. K. Seyd, Andover, Conn., manufacturers' representative and a 20-year veteran with the Triplett sales organization.

George Mucher was promoted to executive vice-president of CLAROSTAT MANUFACTURING Co., Dover, N. H., in a

Clarostat executives William J. Mucher, J. J. Repetto, George Mucher, Walter J. Mucher, Fran J. Chamberlain.

series of top-level personnel changes. Other promotions: Fran J. Chamberlain, sales manager, Distributors Division; Walter J. Mucher, plant production manager; William J. Mucher, chief engineer; and Jacob J. Repetto, superintendent, design and drafting. They have all been associated with Clarostat for years.

Glen McDaniel, the first full-time paid president of the RTMA, announced his resignation, effective October 1, at the association's 28th Annual Convention

B. L. Graham, F. R. Lack, John T. Koehler, Robert C. Sprague, RTMA President McDaniel, and Chairman Plamondon.

at the Palmer House in Chicago. A. D. Plamondon, Jr., president of Indiana Steel Products Co., was elected chairman of the Board of Directors succeed-

ing Robert C. Sprague, president of Sprague Electric Co. He appointed a committee to make recommendations for a new RTMA president. Leslie F. Muter was re-elected RTMA treasurer for his 17th term. Dr. W. R. G. Baker, vice-president of General Electric was reappointed as director of the Engineering Department, James D. Secrest was reappointed secretary and general manager, and John W. Van Allen was renamed general counsel.

Frank R. McMillan joined the INTERNATIONAL RESISTANCE Co., Philadelphia, as assistant Radio Division sales manager. He comes to the company from DuMont where he was a district sales manager in the Cathode-Ray Tube Division.

F. R. McMILLAN

James J. Tynan, former manager of Commercial Sales, was appointed manager of the Equipment Sales Division of RAYTHEON MANUFACTURING Co., Waltham, Mass. He replaces Ray C. Ellis, vice-president, who was named manager of the Raytheon International Division.

J. J. TYNAN

J. A. (Shine) Milling, who recently resigned as director of the Electronics Division of the NPA and chairman of the Electronics Production Board of the DPA to return to private industry, was appointed executive vice-president and general manager of HOWARD W. SAMS & Co., Indianapolis. Before entering Government service, Mr. Milling had been operating vice-president of the RCA Service Company.

J. A. MILLING

Personnel Notes

. . . **Robert A. Penfield**, advertising supervisor of the Tube Division of SYLVANIA ELECTRIC PRODUCTS, was promoted to advertising manager of the Radio and Television Picture Tube Division, Electronics, Parts, and Tungsten and Chemical Divisions.

. . . **Bob Abbott**, advertising manager and assistant sales manager of Littelfuse, Inc., Desplaines, Ill., for eight years, joined the staff of BURTON BROWNE ADVERTISING, Chicago. Herb Cornelius, former field sales manager of Littelfuse, was promoted to sales manager.

. . . **Frederick P. Harvey**, former ad-

vertising and sales promotion manager of SYLVANIA ELECTRIC PRODUCTS' Radio and Television Picture Tube Division, Electronics, Parts, and Tungsten and Chemical Divisions, joined the staff of Fuller & Smith & Ross, Inc., New York City advertising agency, as account executive assigned to the Westinghouse Electronic Tube Division.

. . . **Bob Mosher**, formerly with Art Cerf & Co., will travel in the New England territory for MERIT COIL & TRANSFORMER CORP., Chicago.

. . . **Fred H. O'Kelley, Jr.**, former Cincinnati district representative for the GENERAL ELECTRIC Tube Department, was appointed product manager for G-E receiving tubes.

. . . **Adrian S. Price** joined RMS, New York City, as director of public relations and advertising. He had been with the Dexter Chemical Corp.

. . . **S. H. Van Wambeck** joined the HAMMARLUND MANUFACTURING CO., New York City, as chief engineer, coming to the company from Knapp-Monarch Co.

. . . **Richards W. Cotton** is on a leave of absence from PHILCO CORP., to act as chairman of the Electronics Production Board of the DPA, and director of the Electronics Division of the NPA.

. . . **M. A. De Matteo**, well known in distributor circles, joined the ASTRON SALES CORP., East Newark, N. J., manufacturer of capacitors and of interference filters, to head jobber sales.

. . . **Stanley Kramer** was promoted to chief applications engineer of the Germanium Products Division of RADIO RECEPTOR CO., INC., Brooklyn, N. Y. Herbert Friedman, formerly an engineer with Columbia University, was appointed sales engineer of the division.

. . . **J. H. (Robby) Robinson** was appointed president of RADIO ESSENTIALS, INC., Mount Vernon, N. Y., which has resumed business as a subsidiary agency of American Radio Hardware Co., Inc.

. . . **Robert H. Dolbear** was appointed sales engineer of the Instrument Division of ALLEN B. DU MONT LABORATORIES. He had been with Curtiss-Wright Corp.

. . . **John Ouse**, formerly with American Television Co., joined THOMAS ELECTRONICS, INC., Passaic, N. J., in charge of Midwest sales.

. . . **Morris L. Finney, Jr.**, a former Chicago manufacturers' representative, joined THE FINNEY CO., Cleveland antenna manufacturer, as sales manager.

. . . **Lester C. Harder** and **John B. O'Donnell** were appointed assistant manager and director of purchasing, respectively, for the National Defense Department of MOTOROLA.

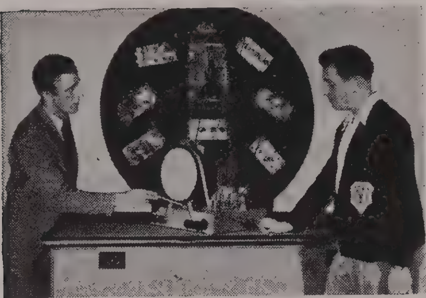
. . . **Arie Liberman**, president of TALK-A-PHONE CO., Chicago, was granted a patent on a new selector device for intercom systems.

. . . **K. B. Shaffer** was appointed manager of kinescope renewal sales of the RCA TUBE DEPARTMENT, Harrison, N. J. D. M. Branigan continues as manager of receiving tube renewal sales, and A. G. Petrasek was appointed manager of electronic components renewal sales, replacing Mr. Shaffer. All are veterans with RCA. Separate kinescope and receiving tube sales functions were created within the renewal sales organization to improve service to the expanding electronics market.

. . . **Graham R. Treadway** joined LAPOINTE-PLASCOMOLD CORP., Rockville, Conn., manufacturer of Vee-D-X antennas and accessories, as assistant to J. L. Respess, president. He was previously president of the Horton-Bristol Mfg. Co. LaPointe-Plascomold also announced that Charles D. Townsend had joined the company as director of manufacturing. He has a wide background in engineering and management.

—end—

Become an Electrical Engineer



MAJOR IN ELECTRONICS

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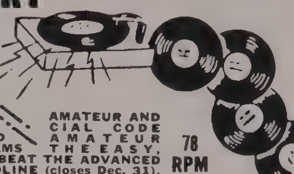

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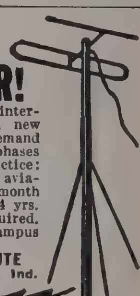

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MATSINGER'S MIDGETS

Dear Editor:

If Mr. Matsinger admits in his article on page 40 of the July RADIO-ELECTRONICS that he might be branded a heretic, he expected what he deserves.

His cutthroat advice is downright ridiculous and an invitation to bankruptcy. The radio service industry has always been plagued by the unwillingness of the public to pay for good service. No wonder it is nearly impossible to hire well-trained technicians. Low wages and abuse by the public are no incentive. With his article Mr. Matsinger does more harm than good to our industry.

Let's face the truth: A customer sets a midget on the counter with the words "Fix it!". You find the usual leaked-out A batteries (the 1R5 blew out last fall; the set was stored away during the winter, batteries and all). You test the set, scrape off all the corrosion (if it hasn't gotten into the tuning capacitor yet), and find only minor damage. So you stick in a new 1R5 and a set of batteries.

This takes you or your technician about 15 minutes. Figuring the cost, we have:

	Our cost		Customer's cost
¼ hour at $1.60	.40	(at $3)	.75
1—1R5 Tube	1.05		2.10
1—67½-volt B battery	1.75		2.50
2—1½-volt A batteries	.16		.25
Ohio State tax			.17
	3.36		5.77

In spite of this being a very minor job *our cost* is $3.36. I could give hundreds of examples. Mr. Matsinger is either a philanthropist, or a shrewd businessman waiting for everyone to go broke with his suggestions and then grab all the business for himself. I do business to make money, and where there is no profit there is no business.

PAUL BOLLER

Springfield, Ohio

(It is unlikely that Mr. Matsinger included battery replacements in his flat rate for *repairing* midget receivers. If you leave the batteries out of account, Mr. Boller's estimate and Mr. Matsinger's are not too far apart.—*Editor*)

SIDELINE SERVICING

Dear Editor:

The letter by William Bacon in the July issue of RADIO-ELECTRONICS hits the nail on the head. The phonies and the failures of the radio and TV repair business have no one to blame but themselves.

This is a land of equal opportunity. If a person can earn an extra *honest* dollar, more power to him. There is no reason whatsoever to accuse the man who is making it in the radio-television repair field.

A. A. LEWIS

Brooklyn, N. Y.

DESIGN AND CONSTRUCTION OF A WHEATSTONE BRIDGE, Published by Technological Developments, 475 Fifth Avenue, N. Y. 17, N. Y. 8½x5½ inches. Ten pages of text (unnumbered). Price \$1.00.

This booklet describes the theory and construction of a simplified Wheatstone resistance bridge with a minimum number of parts. The requirements for maximum accuracy (2%) are emphasized and explained with the aid of simple algebra. Step-by-step procedures are given for calibrating the all-important ratio arms. Recommended layouts, operating instructions, and methods of using the bridge with an a.c. source for capacitance and inductance measurements are included. The English text (which looks like a translation) could be improved, but the schematics and tables should make the subject perfectly understandable to the reader with a knowledge of Ohm's Law and elementary algebra.—*MB.*

A SURVEY OF RADIO-FREQUENCY TRANSMISSION LINES AND WAVE GUIDES, by E. S. Winlund. Published by The Radio Club of America, Inc., 11 West 42nd St., New York 18, N. Y. 8½x11 inches. 64 text pages plus a 22-page advertisement section. Price \$1.50.

This book, Volume 28, No. 2 of the Proceedings of the Radio Club of America, is a historical survey of the development of wave guides and transmission lines with pertinent references and technical data from articles published between 1919 and 1936. Also included is a 17-page bibliography of articles on transmission lines, wave guides, and related subjects published through 1951. This survey, unique in its field, contains much information of value to students and communications-, electronics-, and antenna engineers, and anyone interested in the subjects covered by the survey.—*RFS.*

AUTOMATIC RECORD CHANGER SERVICE MANUAL, Volume 4 (1951, 1952) CM-4 including latest Multi-Speed Changers, Wire and Tape Recorders. Compiled and published by Howard W. Sams & Co., Inc., 2201 E. 64th St., Indianapolis 5, Ind. 8½x11 inches, pages not numbered. Price \$3.00.

This new book is the result of the publisher's continued practice of making up-to-date servicing data available to the service technician in the most convenient form. It is a compilation of 26 Photofact folders covering 16 record changers, 14 tape recorders, 6 wire recorders, and one combination tape and disc recorder.

Changers and recorders made since 1947 are indexed by manufacturer's name and model number and the original Photofact volume and section (folder) number for each unit described in the book. An 11-page cumulative cross-reference shows the names and model numbers of record changers used in receivers and record players of different trade names and models. The style of presentation is familiar to users of Photofact folders and the publisher's specialized servicing-data books.—*RFS.*

RADIO ANTENNA ENGINEERING, by Edmund A. Laport. Published by McGraw-Hill Book Co., Inc., 330 West 42nd St., New York 36, N. Y. 6 x 9 inches, 563 pages. Price $9.00.

This book by the Chief Engineer of RCA's International Division is written particularly for the non-specialist. Practical information, charts, tables, graphs and photos tell the story of antennas. Formulas and higher mathematics are relegated to relatively minor roles.

The design and construction of antennas are described according to frequency. The first chapter covers frequencies up to 500 kc. We find here information relating to ground-wave propagation, high potentials, top loading. The next chapter is about medium frequencies, including the broadcast band. Topics include optimum radiation angle, directivity, tower design, lighting systems, feed methods. The chapter on h.f. (5-30 mc) covers dipoles, V's, rhombics, long wires and directional arrays. Graphs and patterns show how to choose optimum frequency as well as the antenna dimensions and site.

The remaining chapters describe r.f. transmission lines, coupling networks, graphical synthesis of networks and logarithmic potential theory.

TELEVISION PRINCIPLES AND PRACTICE, by F. J. Camm. Published by George Newnes Limited, Tower House, Southampton St., London WC2, England. 5½ x 8½ inches, 215 pages. Price 25 shillings.

Here is an interesting and practical book on British TV transmission and reception by a leading British technical writer and editor. Television cameras, stereoscopic and color TV, time bases, projection systems, aerials, servicing, and interference are among the chapter headings. Topics include interlacing, synchronizing, timing circuits, pulses, power supplies, interference problems, and repair suggestions. The book ends with a 46-page list of TV terms and a survey of the general plan for British TV broadcasting.

Readers who know radio but have only limited experience with TV will get most benefit from this volume.

British, continental European, and American TV standards differ in many respects. Lines per field, frames per second, carrier frequency bands, polarity of transmission, wave polarization, power-line frequency, even circuits and nomenclature differ. The non-British reader must keep these differences in mind in using this text as a reference source.—*IQ*

ELECTRONIC ANALOG COMPUTERS, by Granino A. and Theresa M. Korn. Published by McGraw-Hill Book Company, 330 West 42nd St., New York, N.Y. 6 x 9 inches, 378 pages. Price $7.00.

These authors have prepared a complete description of a subject they know well. The design and operation of analog computers are described clearly and in detail. Starting from elementary electronic principles, the book shows how computers are constructed, tested,

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Radio-Electronics does not assume responsibility for any errors appearing in above index.

and applied. An entire chapter is devoted to the important subject of setup procedures. The reader must know something of calculus. Although the computer does the actual work of solving a problem, the operator must first set it up. Often the problem involves differential or integral calculus.

The third chapter shows practical applications. Typical equations are given for problems like flight of aircraft, oscillations, ballistic paths. Block diagrams show how the computer is set for the particular equation to be solved. Following chapters discuss potentiometers, differentiators, integrators, operational amplifiers, function generators, recorders, and other topics. The final chapter is devoted to complete installations. Among instruments described are those by Boeing, Goodyear, Curtiss-Wright, and Reeves.—*IQ*

SOUND RECORDING AND REPRODUCTION, by J. W. Godfrey and S. W. Amos. Published for Wireless World by Iliffe & Sons, Ltd., Dorset House, Stamford St., London, England. 5½ x 8½ inches, 271 pages. Price $6.75.

This book was prepared as a source of practical instruction for BBC engineers. It describes principles and equipment for disc, film, and tape. Most of the book covers disc recording, reproduction, and processing. BBC and Presto equipment is illustrated. Cutters, equalizers, playbacks, amplifiers, and frequency characteristics are among the subjects.

Only one chapter (20 pages) is devoted to tape. This hardly seems sufficient, considering the widespread use of tape in modern broadcasting. Principles and equipment are only briefly described. Film is also given a single chapter.

The appendices contain much interesting information for the recordist. Sapphire cutters, induction motors, film scanning, and frequency fluctuation (wow) are analyzed.—*IQ*

INTRODUCTION TO INDUSTRIAL ELECTRONICS, by R. Ralph Benedict. Published by Prentice-Hall, Inc., New York, N. Y. 5¾x8½ inches, 436 pages. Price $7.00.

This book teaches principles and practices of industrial electronics. It covers much ground and is clearly written. The first half of the book covers vacuum and gas tubes and their circuits. It describes the cathode-ray oscilloscope, thyratron, X-ray tube, phototubes, and many other special types. Amplifiers, oscillators, and detectors are discussed. The last half is devoted to practical applications of electronics. There are chapters on controlled rectification, power conversion, high-frequency heating, electronic relays, control, and instrumentation.

The author stresses the use of load lines and tube graphs, the logical method for designing tube circuits. No higher mathematics is needed.

Exercises and references complete each chapter.—*IQ*

—end—

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